In-service Training System using IT Networks: Development of an In-service Training Program to Support the Development of Units for Integrated Study (in the Field of Natural Science)*

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1. INTRODUCTION

Methods for teacher education in a society of advanced information technology have been discussed in recent years. Within this discussion, in-service training programs using IT networks have started to attract attention (Okamoto et al., 1998).

Recently, long-distance lectures have been held using the Space Collaboration System (SCS), which makes use of communication satellites (Araki et al., 1998), and fiberoptics technology has also been used for video conferences (Kondo et al., 1999) and so on. However, the terminals necessary for these systems are not installed in most elementary or junior high schools etc., and it is therefore necessary for teachers to leave school grounds and gather in a specified location in order to carry out in-service training.

In order to overcome such problems, Video on Demand (VOD) has been used to try out long-distance training (Okamoto et al., 1998; Uchiyama & Ikuta, 1998). For example, VOD has a database of classroom images on the Internet, and this training can be undertaken by teachers at their place of work. This alleviates geographical limitations, and also allows teachers to freely choose the contents of their training.

However, at the present stage, training through VOD on the Internet is only a one-way service, directing information at the recipients of the training. In order to make future in-service training using information networks more practical, it is thought necessary to provide an environment where the teacher can undergo training without leaving school grounds, but where they can also interact with the trainers.

Based on the above realities, we, the authors of this paper, have aimed to construct a practical support environment for in-service training. For this purpose, we have developed an in-service training program based on VOD via a CATV network, coupled with video conferencing capabili-

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ties. This research project has been realized in conjunction with other project members (Yamaguchi et al., in press). This report gives an outline of the system, and also an outline of the in-service training program to support the development of units for integrated study (in the field of natural science) that we have developed.

2. IN-SERVICE TRAINING SYSTEM

2-1. Development concept

The development concept behind this system was to "provide, through coordination between universities, government authorities, schools attached to universities, public schools and corporations, a network environment able to supply training to teachers and their schools. This training should take the form of tackling problems that exist among the teachers and schools undergoing the training." The current system has aimed to realize the following three features in the support environment, based on the above concept.

    (1) To present intellectual resources held by universities, government authorities, schools attached to universities, corporations etc. in such a way that they can be realistically used by public schools receiving training, in order to improve educational standards.

    (2) To go beyond the mere provision of information to the person or organization undergoing training, and to follow the process through with support for the targeted school or teacher in implementing the knowledge which they have acquired through the training program and in solving any actual problems that they face.

    (3) To provide opportunities for both the trainers and the teacher receiving training to experience a mutual learning process with regard to educational improvements.

As the tasks presented during the training are aimed at solving the problems faced by the individual or school taking the training program, the current system requires the person receiving the training to take a "learning for oneself" approach, rather than expecting merely to "be taught."

Also, in order for the universities, government authorities, schools attached to universities and corporations which provide the training to solve the actual problems faced by the recipients of the training, these institutions are able to study methods in how to best providing the intellectual resources that they possess. For example, opportunities will be provided to schools attached to universities to reflect on their own experiences in the classroom, in order for them to convey their educational know-how, which they have acquired through actual experience, to public schools in a manner whereby the information can be practically used by those public schools.
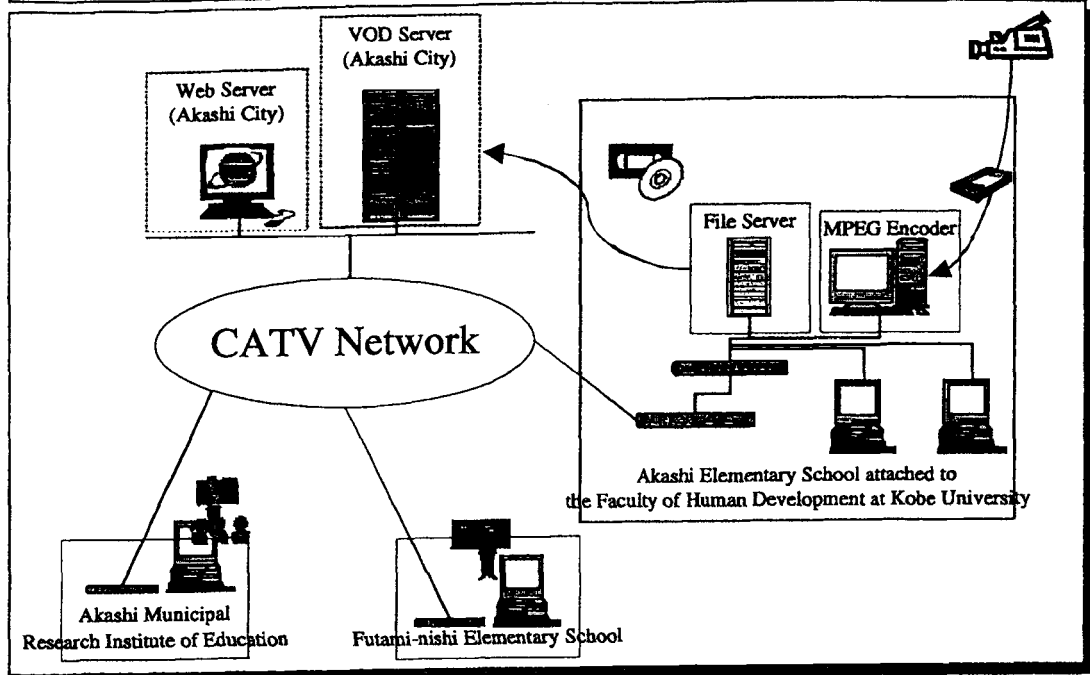
2-2. System configuration

Figure 1 shows the configuration of the system (Ikari et al., 2000). The VOD server, WWW server and CATV network are owned and kindly loaned to us by Akashi City.

2-2-1. Video on demand system

In the video on demand system, the use of a CATV network guarantees a high-speed network

Video On Demand System

VOD Server
(Akashi City)

Web Server
(Akashi City)

File Server

MPEG Encoder

CATV Network

Akashi Elementary School attached to
the Faculty of Human Development at Kobe University

Akashi Municipal
Research Institute of Education

Futami-nishi Elementary School

Video Conferencing System

VOD Server
(Akashi City)

Web Server
(Akashi City)

File Server

MPEG Encoder

CATV Network

Akashi Elementary School attached to
the Faculty of Human Development at Kobe University

Akashi Municipal
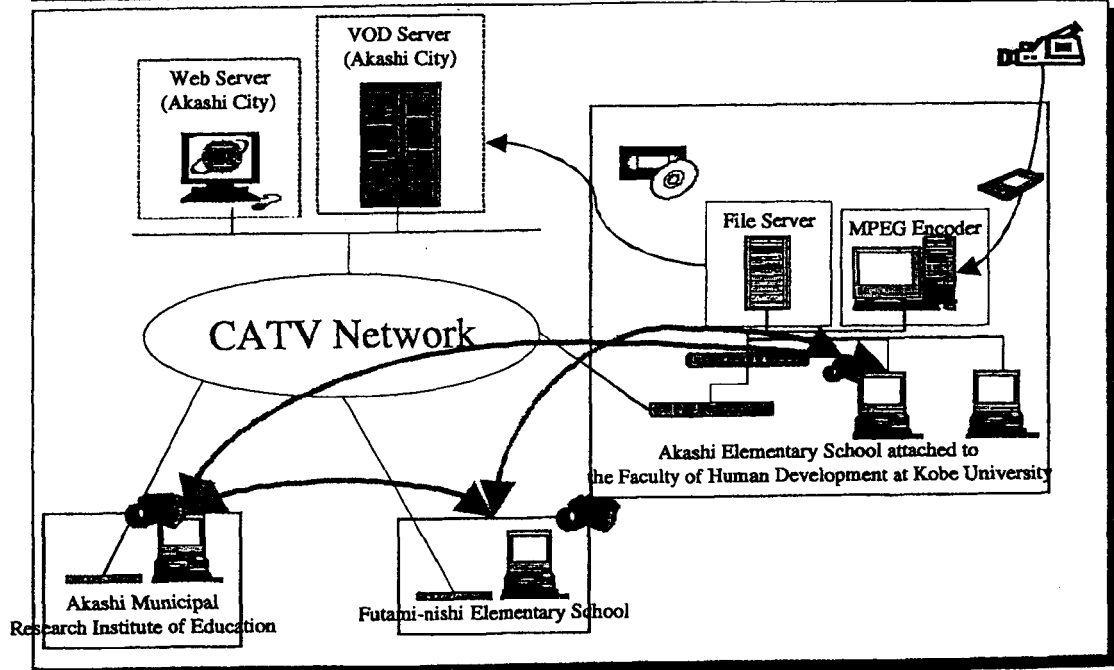Research Institute of Education

Futami-nishi Elementary School

Figure 1. Configutration of in-service training system

environment (Maesako, 1999). Via the CATV network, images are provided from the VOD server to the terminal in MPEG2 format. The images are linked to HTML files on the WWW server, and so images and written information can be accessed from the terminal in the same way as accessing a homepage.

2-2-2. Video conference system

The video conference system uses Cu-SeeMe (R) Pro and a digital board. Images, sound, written information, as well as images drawn on the board can be sent and received.

2-2-3. In-service training course

The 7 in-service training courses operated on this system were developed. The development of each program was shared by the research project members.

(1) Training using dance therapy methods in addressing problems of school phobia and bullying;

(2) Development of teaching materials for arithmetic and mathematics;

(3) Improvements in the education and care of infants;

(4) Development of units for integrated study (in the field of natural science);

(5) Development of units for integrated study (in the field of humanities);

(6) Training for administrative staff; and

(7) Support for child rearing.

3. IN-SERVICE TRAINING PROGRAM IN SUPPORT OF THE UNITS FOR INTEGRATED STUDY (IN THE FIELD OF NATURAL SCIENCE)

3-1. Investigation of targeted teachers: Actual situation in schools targeted for training, and their demands.

In order to reflect the actual situation and demands of the schools receiving training into the program, and at the same time to gain indications about the provision of a support environment in future program operation, we carried out a survey of what kind of training contents were anticipated by teachers who would receive the training, and their image of the way in which they would use such long-distance training.

3-1-1. Method

Subjects. The survey was made in early June, 2000. All teachers working at Akashi Municipal Futami-nishi Elementary School, which is a school targeted by the training program. In total, 26 teachers were surveyed.

Questionnaire. There were a total of 20 items relating to the contents of the training program, drawn up with reference to Yoshizaki (1991). There were a further 15 items relating to the use of long-distance learning programs, drawn up with reference to Shimizu (1992). Teachers were requested to respond to each of the items by choosing a response from 4 alternatives (strongly agree, agree, disagree, strongly disagree).

Procedure. Responses to items were made individually and filled in on a response sheet. There were no particular limitations on time for completing the responses.

3-1-2. Results and consideration (1): Expectations of teachers in relation to training contents

Table 1 shows the responses to items relating to training contents. For all 20 items, the majority of the teachers' survey group responded with "strongly agree" and "agree." In particular, all teachers responded with "strongly agree" or "agree" in relation to the item, "Experimental approach of pilot schools." The above responses revealed that there are generally high expectations of the integrated study training program. It also became clear that the "Experimental approach of pilot schools" was the most highly anticipated content of the training program.

3-1-3. Results and consideration (2): Image of the use of long-distance training programs

Table 2 shows the responses to the given items. In relation to items such as, "Training contents are made easier to understand by the use of video clips, and not just written information," and "It is possible to have two-way communication with trainers in universities and other schools, while remaining in one's own school," more than 20 teachers made the response "strongly agree" or "agree." On the other hand, more than 20 teachers also replied "strongly agree" or "agree" in response to the items "Operation of the equipment is difficult" and "There is a limit to where long-distance training can be carried out within the school, making it difficult to use" (Yamaguchi et al., 2000).

From the above responses, it firstly became clear that the targeted school gave a positive evaluation to certain features of this program, such as the use of video on demand and video conferencing system for long-distance learning. From this result, we can expect teachers to have a high level of motivation with regard to the operation of future training programs. On the other hand, the survey also revealed that teachers feel uncertain about the operation of the equipment etc. It is thought that this indicates a need for technical support when operation of the program is started, through the dispatch of support staff etc.

3-2. Selection of program topics

The in-service training program to support the development of units for integrated study (in the field of natural science) was jointly developed by members of the Faculty of Human Development, Kobe University (the authors) and by members of Akashi Elementary and Junior High Schools attached to the Faculty of Human Development at Kobe University.

From the above survey into teachers' expectations of the training contents, it became clear that the teachers of the targeted school had high expectations of a program that would actively present actual educational results from pilot schools of in integrated study. Based on these findings, all members, including the present writers, are currently working on the development of a program for the "Use of a concept map for integrated study." This program presents, in a practical manner, the

TABLE 1

Expectations of teachers in relation to training contents (*N* = 26)

	Question	Responses SA	A	D	SD
(1)	Methods for improving situation regarding facilities and equipment (including space).	4	15	7	0
(2)	Methods for appreciating children's reality (existing knowledge, concerns, attitudes etc.)	6	16	4	0
(3)	How to create learning formats/ configure activities (individual, small group, whole group etc.)	7	15	4	0
(4)	How to draw up objectives for units and lessons.	5	19	2	0
(5)	Evaluation methods and timing.	4	18	4	0
(6)	Methods for improving traits of educators (educational views, impact of lessons etc.)	7	16	3	0
(7)	Methods for grasping features of educational materials (including all materials used in lesson).	10	13	3	0
(8)	Teaching methods.	10	12	4	0
(9)	Methods for deciding the contents of learning activities.	6	14	6	0
(10)	Methods for organizing study time (how to divide up classroom time etc.)	4	15	6	1
(11)	How to write guidance proposals.	0	17	9	0
(12)	How to plan and operate teaching forums.	4	16	6	0
(13)	Experimental approach of pilot schools.	11	15	0	0
(14)	How to make use of regional characteristics.	6	14	6	0
(15)	How to form links with regional society outside school.	4	17	5	0
(16)	The abilities we wish to nurture through integrated study.	11	13	2	0
(17)	A desirable image of the child through integrated study.	5	18	3	0
(18)	Theories relating to integrated study.	8	15	3	0
(19)	How to link integrated study with learning by subject.	9	14	3	0
(20)	How to link integrated study with school events.	6	17	3	0

SA, strongly agree; A, agree; D, disagree; SD, strongly disagree

TABLE 2

Image of the Use of Long-distance Training Programs ($N = 26$)

Question	Responses			
	SA	A	D	SD
(1) It is possible to undergo training which accords with one's own interests and aims.	2	15	9	0
(2) It is possible to undergo training at any time that is suitable to oneself.	2	11	13	0
(3) It is possible to acquire the latest information on integrated study.	7	16	3	0
(4) It is possible for teaching staff to undergo training freely and individually.	2	15	9	0
(5) It is possible for teachers from various schools to undergo the same training together.	2	19	5	0
(6) It is possible to repeat certain training contents as many times as is wished.	3	16	7	0
(7) Training contents are made easier to understand by the use of video clips, and not just written information.	9	16	1	0
(8) It is possible to undergo training which conforms closely with the problems and issues faced by one's school.	2	14	10	0
(9) It is possible to have two-way communication with trainers in universities and other schools, while remaining in one's own school.	3	18	5	0
(10) Operation of the equipment is difficult.	7	16	3	0
(11) Maintenance and management of the equipment is difficult.	6	15	5	0
(12) There is a limit to where long-distance training can be carried out within the school, making it difficult to use.	2	20	4	0
(13) There is insufficient direct experience of classroom observation and making of educational materials.	1	13	11	1
(14) There are no clear benefits of using long-distance training.	1	17	8	0
(15) You cannot be there in person, making it difficult to understand the contents of the training.	0	15	11	0

SA, strongly agree; A, agree; D, disagree; SD, strongly disagree

methodology being used for a student-centered approach at Akashi Elementary School, where students configure their own study units.

There were 4 reasons, given below, for selecting the topic of "Use of a concept map for integrated study."

(1) Akashi Elementary School is a pilot school of integrated study (The Kindergarten, Akashi Elementary School, and Akashi Junior High School Attached to the Faculty of Human Development at Kobe University, 1996).

(2) The targeted users of the current program are elementary schools, and therefore it was deemed suitable to have an elementary school presented as the pilot school in the program.

(3) The configuration of units for Akashi Elementary School is an actual example of a student-centered approach, where unit topics actively present the ideas of the children and the subjects that they wish to study.

(4) The concept map is a methodology that was used in the configuration of units by Akashi Elementary School for topics covering events and phenomena related to natural science.

4. CONFIGURATION OF PROGRAM FOR THE "USE OF CONCEPT MAPS FOR INTEGRATED STUDY"

This program is currently under construction.

4-1. Video clips provided by video on demand system

The Video clips provided by the video on demand system are displayed on the terminal equipment of the target school through a WWW browser interface, as shown in Figure 2. MPEG2 format images are shown on the left-hand side of the window, while the right-hand side of the window displays written information explaining the contents of the images.

4-1-1. What are concept maps?

This clip form an introduction to the program. The teacher of Akashi Elementary school as commentator explain such things as how Akashi Elementary School teachers are carrying out student-centered unit configuration for integrated study, and how they use concept maps for that purpose. The screen presentation is approximately 2 minutes long.

4-1-2. How to make a concept map

This clip give a brief explanation of the fundamental methods used for making concept maps. The commentator actually makes a concept map on a whiteboard, and presents key terminology, such as label, link, and linking words. He also presents points about typical concept maps, such as the layer-type or star-type concept map, how to select and arrange labels, how many labels to use, and how to draw links etc. The screen presentation is approximately 5 minutes long.

Last Update September 20, 2000

In-service Training Program to Support the Development of Units for Integrated Study (in the Field of Natural Science)

USE OF CONCEPT MAPS FOR INTEGRATED STUDY

When conceiving a framework for student-centered integrated study, it can be extremely useful to use a concept map. This program enables you to learn basic concept map methodology. The program also considers actual practical methods of use, based on various case examples from the classroom.

(1) What are concept maps?

(2) How to make a concept map

(3) Case example using a concept map 1 (lesson version): Lesson where whole class makes one concept map

(4) Case example using a concept map 2 (explanation): Lesson where whole class makes one concept map

(5) Hints for using a concept map: Voices of the teachers

(6) Tasks. Unit configuration based on children's concept maps (video conference)

(7) Possibilities of the use of concept maps for integrated study (video conference)

Literature/ reading material related to concept maps

There are many books published about concept maps. They are mostly related to the field of science education

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Case example using a concept map 1 (lesson version):

Lesson where whole class makes one concept map

This Grade 5 class shows the introduction of a unit for learning about the ocean in summer. The teacher and children discuss the topic while making a concept map on the blackboard, thus formulating a study plan for the unit as a class.
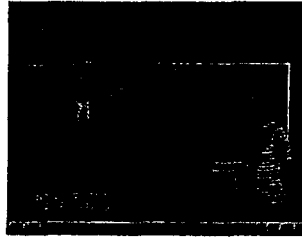Flow of the class:
(1) The teacher gets the children to report on what they like about the ocean in summer and what they wish to study about the ocean.
(2) The central label is "the appeal of the ocean," and other labels are written around it on the blackboard, containing words suggested by the children.
(3) The labels on the blackboard are categorized. The category frameworks (a title for each category) are suggested by the teacher and items suggested by the children
(4) The children are asked to specify which items from the concept map on the blackboard they would like to study in the future.

op page of program

Case example using a concept map 1 (explanation):

Lesson where whole class makes one concept map

Particular features of this lesson's concept map
(1) The labels suggested by the children are categorized and each category is given a title. It is a variation on a layer-type concept map.
(2) The main point of the activity is for the children to create labels by reporting on their images of the appeal of the ocean, and therefore links and linking words are omitted.

Points when using the concept map in class:
(1) By displaying the label ЛThe appeal of the ocean at the beginning of the class, the teacher aimed to draw out what the children think on the topic.
(2) The teacher tried to predict what the children would think of, and thought of some categories before the class.
(3) The labels suggested by the children were summarized into the categories previously thought of by the teacher. However, the children were also asked to consider how to categorize the items
(4) When the labels were being put into categories, different colored chalks were used.
(5) Labels suggested by the children were directly used as the titles for some of the categories.
(6) The labels actually suggested by the children exceeded the predictions of the teacher to a great extent. The teacher did not stick to his or her own ideas, but continued to draw ideas one after the other from the children.

Figure 2. Video clips provided by video on demand system

4-1-3. Case example using a concept map 1 (lesson version): Lesson where whole class makes one concept map

This is a case example of a lesson where a concept map is used for integrated study. The whole class carries out a discussion, while the teacher makes one concept map on the blackboard. The lesson was conducted with Grade 5 students and the topic was 'the ocean in summer.' The class develops as follows:

(1) The teacher gets the children to report on what they like about the ocean in summer and what they wish to study about the ocean; (2) the central label is "the appeal of the ocean," and other labels are written around it on the blackboard, containing words suggested by the children; (3) the labels on the blackboard are categorized into a framework of items suggested by the teacher and items suggested by the children; (4) the children are asked to specify which items they would like to study in future from the concept map on the blackboard. The screen presentation is approximately 2 minutes and 30 seconds long.

4-1-4. Case example using a concept map 2 (explanation): Lesson where whole class makes one concept map

This clip consist of an explanation of the lesson conducted in 4-1-3, and the explanation is made by the teacher of the class and by the commentator. The teacher answers questions posed by the commentator, who finally offers a summary of the contents. The explanation focuses on the features of the concept map introduced into the class, and on things to be considered by the teacher when using a concept map, such as hints on the aims of the concept map and points of guidance in using a concept map.

In this section, the features of the concept map in the lesson shown are explained. Features include the fact that the concept map is a variation on a layer-type map, and also the fact that links and linking words are omitted, because the main point of the activity was to get the children to report their images of the appeal of the ocean. Further, points for consideration by the teacher are given. These include the fact that the teacher was trying to encourage the children to state what they like about the ocean, and also that the teacher actively created labels and frameworks as given by the children's ideas, without insisting on limiting the map to the teacher's own point of view etc. The screen presentation is approximately 4 minutes long.

4-1-5. Hints for using a concept map: Voices of the teachers

This clip is not yet complete. This section deals with the advantages and disadvantages of introducing concept maps, and it is planned to provide comments directly from the teachers at Akashi Elementary School in relation to points to consider when introducing a concept map and also hints for the effective use of concept maps. It is also planned to display concept maps drafted by each teacher in the classroom, and ask the teachers to explain their maps. The teachers appearing in this clip will be teachers who have long years of experience with using concept maps, newly appointed teachers who have tried out concept maps for the first time recently, and teachers who try out new techniques etc.

4-2. Video conferences relating to the use of concept maps in integrated study

After teachers targeted by the training have watched and listened to the contents provided by the video on demand system as previously explained, it is planned to carry out video conferences between the teachers who have undergone the training (targeted learners) and trainers who created this program. It will of course be possible for targeted teachers and trainers to refer to the contents of the video on demand system during the video conference. The contents of the conference will consist of a question and answer session with regard to the contents described above, and also the following two points.

4-2-1. Tasks: Unit configuration based on children's concept maps

At this conference, the teachers at the school targeted by the training will be provided, via the WWW server, with children's concept maps from Akashi Elementary School. At the same time, they will be presented with the question, "How would you evaluate these concept maps and come up with ideas for future units?" During this conference, both sides will be able to refer to the concept maps displayed on the homepage, and teachers from the target school will be requested to explain their own methods of evaluation and ideas for units based on their evaluation. The trainers will also present their methods of evaluation and their unit ideas. It is thought that this conference will provide target school teachers and teachers as trainers with the opportunity to deepen their mutual understanding of how to appreciate the children's reality through their concept map, and how to create unit and lesson objectives which make full use of that appreciation.

4-2-2. Possibilities of the use of concept maps for integrated study

At this conference, teachers undergoing training and trainers will discuss the possibilities of the use of concept maps for integrated study. Discussions could cover, in as concrete terms as possible, the first introduction of concept maps into target school lessons, what kind of units could be introduced, and what kind of skills the teachers will need in accomplishing said introduction. The tasks for discussion in this conference will be posted on the homepage.

4-3. Homepage of program

As an introduction to available literature, this homepage gives a list of reading materials related to concept maps in the field of science education. Through such literature, it is thought that teachers targeted by the training program can be provided with information about actual educational results obtained through the introduction of concept maps.

5. FUTURE TASKS

It is planned to carry out future evaluation of the program through trials of the program that has been developed. Further, the contents of the program will be enhanced through the introduction of

actual examples of classroom use, such as the section, "Hints for using a concept map: Voices of the teachers." At the same time, it is also planned to progress with the development of other programs.

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