NIGHT SYSTEM AND ITS SOFTWARE

I. Kubo, S. Hatta, Y. Soeda, C. Suzuki and M. Miyamoto

PREFACE

The 2nd World Conference on "Computers in Education" was held at Marseilles in France under the sponsorship of IFIP (International Federation for Information Processing) from September lst to 5th, 1975. The lst World Conference on "Computers in Education" was held at Amsterdam, Holland in 1970. The papers presented at the 2nd conference numbered one hundred and eighty. All these papers are printed in O. Lecarme & R. Lewis: IFIP, Computers in Education, Vols.1 and 2, North-Holland Publishing Company (Amsterdam, Oxford) and American Elsevier Publishing Company, Inc. (New York).

Those papers were read in the form of a panel discussion, were divided into fifteen sessions, at Faculté de Médecine in Marseilles over four days. The participants were approximately one thousand; the participating countries were about fifty, among which the presented papers from Japan were six, with twenty or so Japanese participants.

Kubo and Hatta presented a report under the title of "NIGHT system;: prefectural-wide CMI system," taking twenty minutes in "Session L1C: Reports on CMI Projects" on September lst. The proceedings of this conference are to be published later.

Part I of the present paper was written as an oral report, including an addition to our previous contribution (before Oct. 1974) of our further study, as requested by the organizing committee. Part II consists of two articles: 〔A〕 an example study on the classroom learning-teaching in the NIGHT system, and 〔B〕 an example study on the individual learning-teacing in the NIGHT system. Each article was prepared and completed by Soeda & Suzki, and by Miyamoto respectively. We, however, had no chance to present Part II at the conference. This is the reason why we have asked for some space for our writings in this bulletin. (I. Kubo)

PART I

NIGHT SYSTEM PREFECTURAL-WIDE CMI SYSTEM

Nagasaki University
Ikumaro Kubo and Shohei Hatta

We have come to Marseilles to report on our research on CMI in Japan, as representatives of the NIGHT system project team of Nagasaki University.

Now let us explain the outline of our work with the aid of a series of slides, T.P.

Our project has been carried out by the united efforts of many people. So

<Fig. 1>

The NIGHT system staff

(1)	Leader	I. Kubo
(2)	Microwave	I. Kubo and A. Owatari
(3)	Computer	S. Hatta, I. Yotsuji and A. Oikawa (Tsukuba Univ.)
(4)	Development of Learning Programs	M. Miyamoto, M. Wakatsuki, K. Taketomo, M. Hirose, Y. Soeda, C. Suzuki, M. Noguchi, H. Kawasaki, S. Saeki

Schools cooperating with the NIGHT system

(1) Primary school
- N: Nagasaki — Sako, Fuzoku, Minamiooura
- I: Iki — Naka
- G: Goto — Fukue
- H: Hirado — Hirado
- T: Tsushima — Toyotamaminami, Ootsuki

(2) Secondary school (Junior high school)
- N: Nagasaki — Ebira, Shikimi, Minami, Fuzoku
- I: Iki — Numazu, Hakozaki, Mushozu
- G: Goto — Tomie
- H: Hirado — Chuubu, Nanbu
- T: Tsushima — Izuhara, Hisada

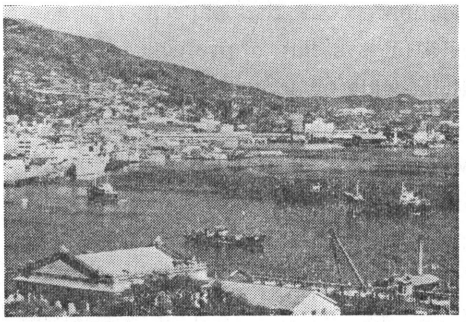
The Education Bureau, Nagasaki Prefecture
Basic Science Research Grant Aid by the Ministry of Education, Japanese Government, since 1971

let us first introduce these members. <Fig.1> We also should mention that this research has been supported to a great extent by the Science Education Fund granted by the Ministry of Education of the Japanese Government.

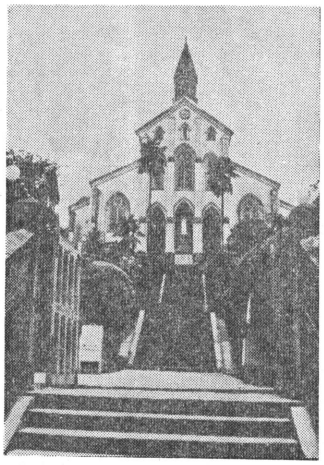
Well next, we want to give you some preliminary knowledge about the district where our research is being conducted. Nagasaki City is located in the western end of Japan, and is about 1000km away from Tokyo, the capital of Japan. <Fig.2>Fur years ago, it has been a port town. <Fig.3>During the period of the national isolation in the Edo Era, which extended for over three hunded years, was the only port open to European culture. Consequently, even now there live Catholics in no small number. <Fig.4> It is also known for the atomic bombing. We may also say that Nagasaki city,

<Fig. 2>

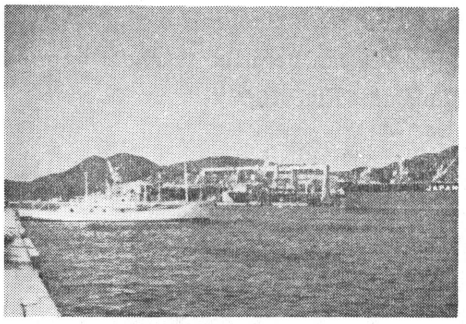
<Fig 3 .>



<Fig. 4 >



<Fig. 5 >

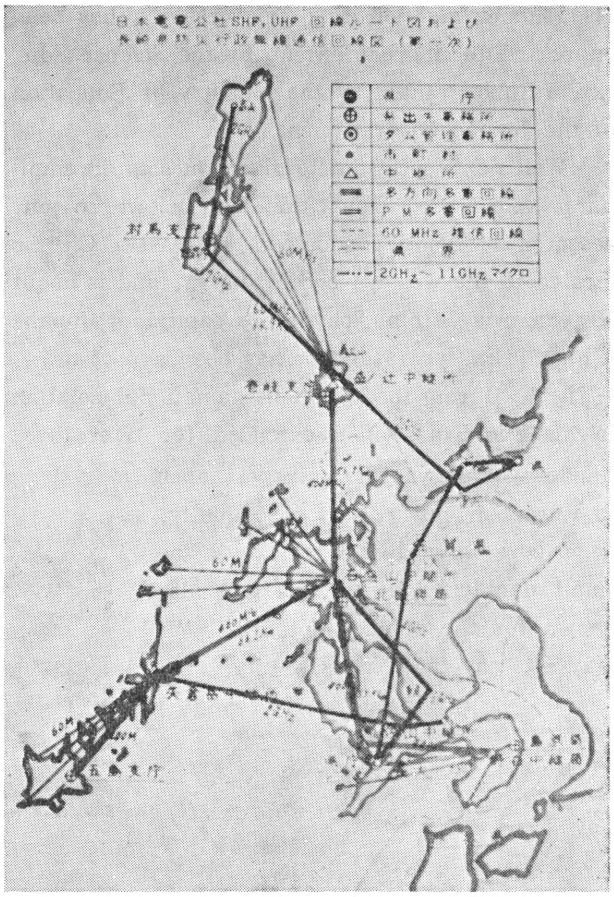


though famous for its ship-building industry, is a beautiful city, just like Marseilles. <Fig. 5>

Nagasaki City is the center of Nagasaki Prefecture. Within the Prefecture there are a great number of isolated islands. <Fig.6> The major islands are Iki, Goto, Hirado, and Tsushima, and "NIGHT", that is, the name of our research project stands for the initials of these islands together with that of

Nagasaki City.

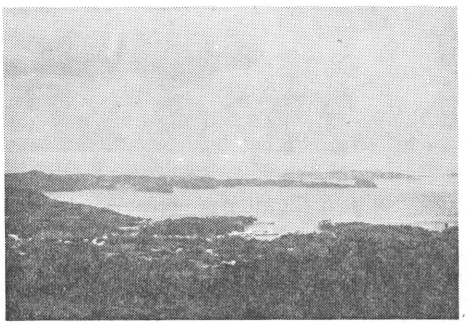
<Fig. 6>



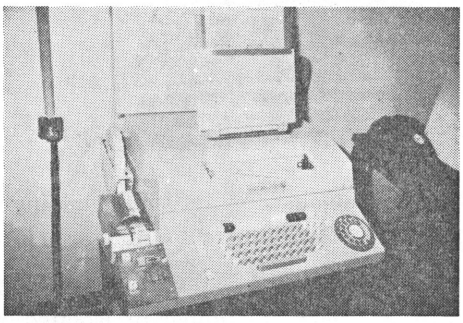
Because of the present gravitation of population toward cities, these islands are blessed with beautiful nature, <Fig. 7>, on the other hand, they have a lot of difficulties in education, particularly in realizing a progressive, new education. It takes many hours to travel from islands to Nagasaki City or other central cities. (See, "Introduction" in the paper, NIGHT system; a prefectural-wide CMI System.)

Such being the case, we've thought of using a microwave network and inquired whether data communication by telex <Fig. 8>, teletype and facsimile, that is, the commercial name of telesteleographe <Fig.9> can help the teachers improve their teaching at schools on these remote islands. <Fig. 10>

<Fig. 7>



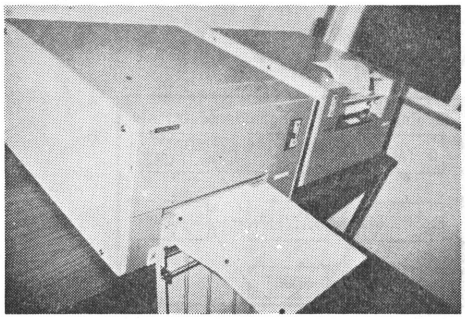
<Fig. 8>



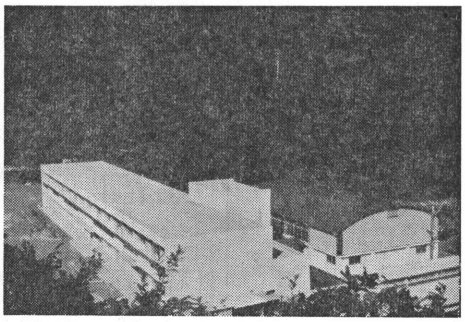
National education in Japan has been rapidly popularized for these one hundred years. In the Japanese school system, however, each class has from

40 to 45 pupils, and classroom teaching has been rather traditionaly. But in such circumstances, the persons concerned have made all possible efforts to have each pupil extend his own learning ability.

<Fig. 9>



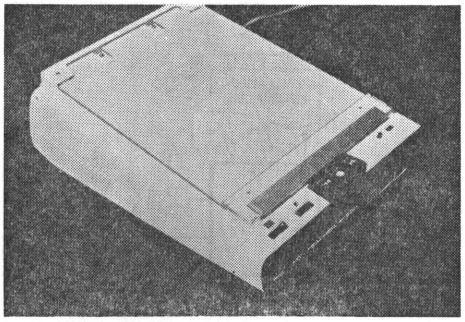
<Fig.10>



Nowadays response analyzer, as shown in <Fig.11>, widely are used so that a teacher can check his pupils' responses promptly. In addition, a machine like the Synchrofax <Fig.12> for an individual learning, is also widely used.

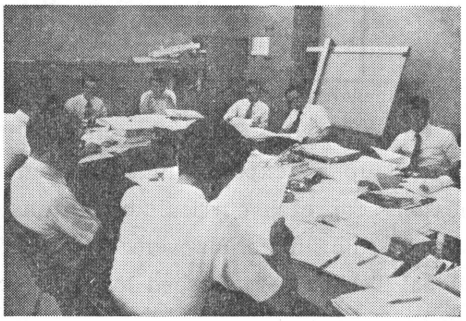
<Fig.11>

<Fig.12>



Yet we can hardly expect that a teacher who is forced to teach many subjects to many pupils can manage his work with complete success. He stands in need of information much from many teachers' experiences, In particular, he needs to know how to diagnos and evaluate his pupils' achievements and is in need of the systematization of them all. <Fig.13>

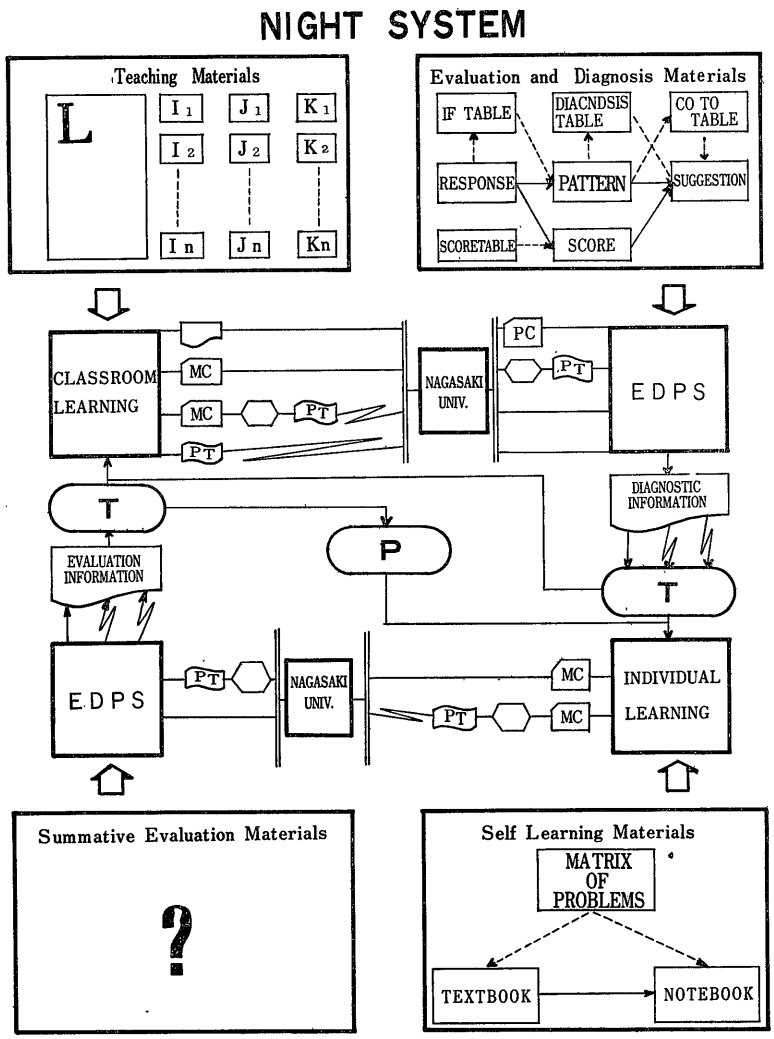
<Fig.13>



The NIGHT system is a research project which has been contrived to solve the above-mentioned problems for these several years. Though it is still

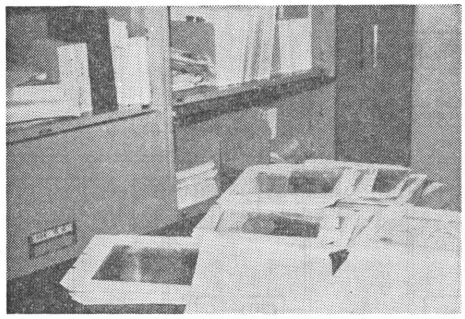
under development this chart shows the total system of the NIGHT system <Fig. 14> : The central part illustrates the whole execution process and the materials prepared for carrying out the process are illustrated in the four surrounding frames.

<Fig.14>

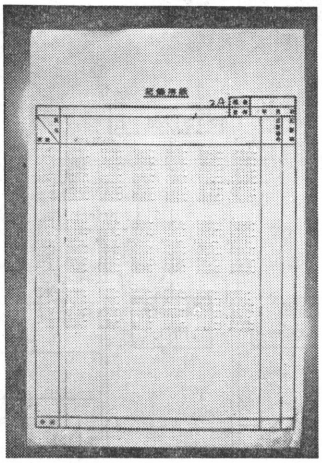


First of all, teaching materials for the classroom must be fully prepared. We set up an experimental program consisting of from 10 to 20 school hours' lessons for each curriculum, such as arithmetic, science, etc., These programs and teaching materials were researched and constructed at the Center of Educational Technology attached to the Faculty of Education of Nagasaki University. <Fig.15>

<Fig.15>

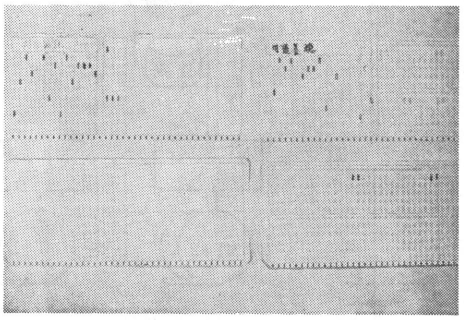


<Fig.16>



In every classroom work, pupils' responses are to be checked and recorded by a paper tape puncher of a response analyzer or by a typewriter. <Fig. 16> If neither of them is available, the responses are written down on mark cards.

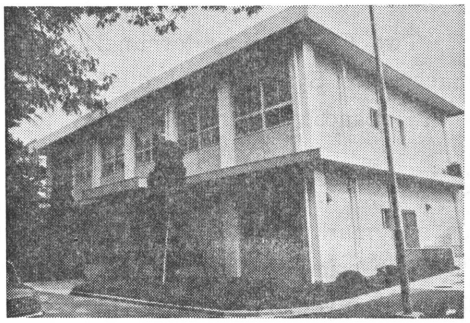
<Fig.17>



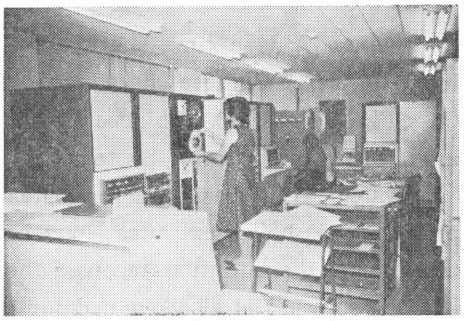
These data are to be recorded, preserved, analyzed, converted, and ultimately utilized for classroom teaching or individual teachings.<Fig. 17> Since it is, however, difficult for an individual teacher to do the entire work by himself, a central data processing system is required.

In the course of this research, the Center of Educational Technology was established tn the Faculty of Nagasaki University <Fig.18> and has been equipped with a computer system called "Synthetic Information Processing System of Isolated Islands' Education", that is, the EDPS for the NIGHT system. <Fig.19> This system consists of three sub-systems, and it has three CPUs: 64KB, 64KB, and 16KB respectively. <Fig.20>

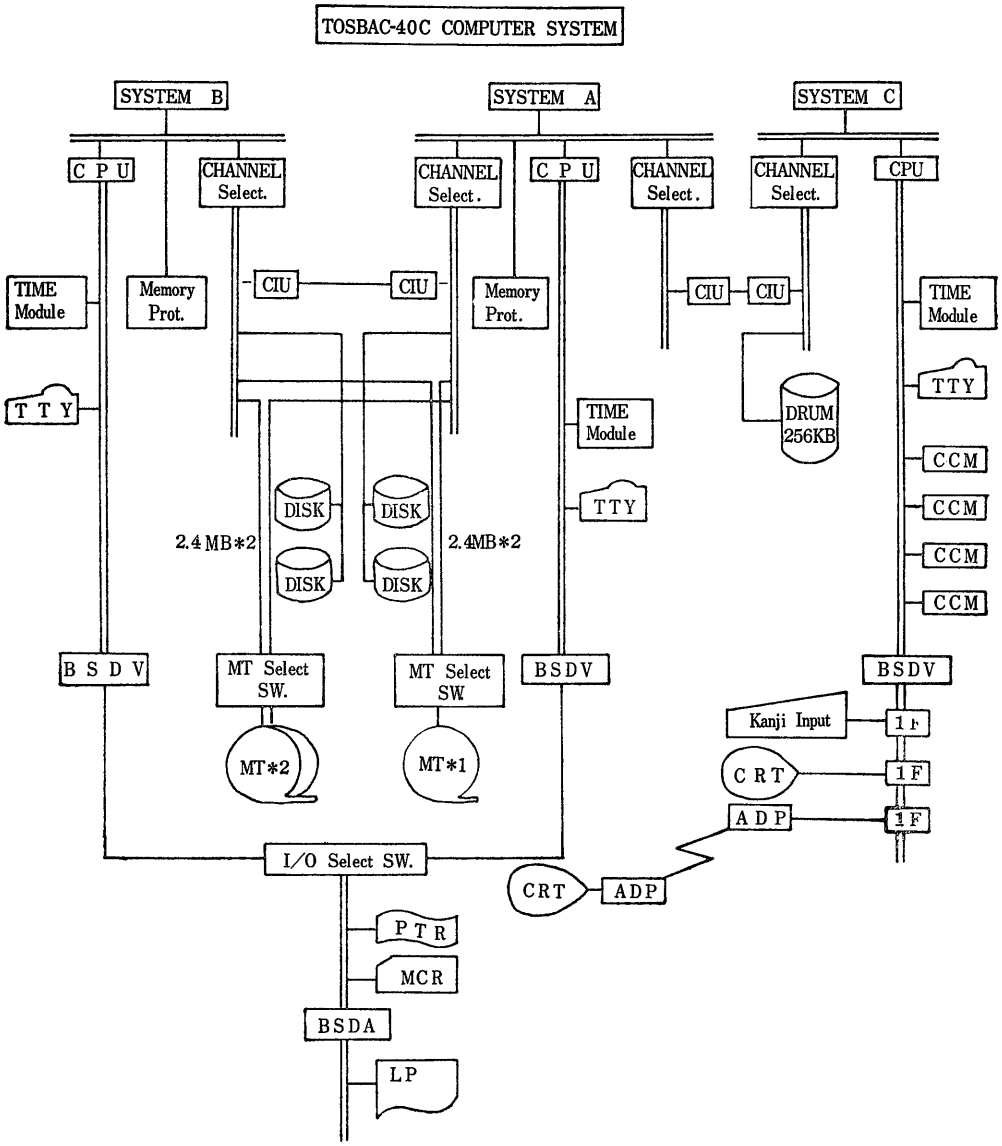
<Fig18>



<Fig19>



<Fig.20>

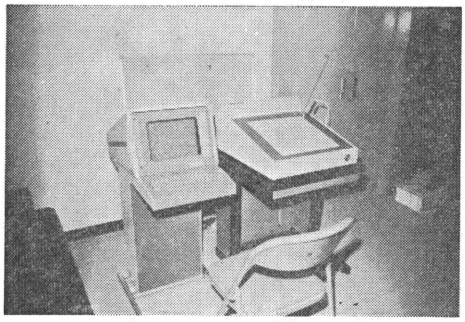


System A is a time sharing system. Two CRT display terminals and an input device of Chinese characters are connected to System A through System C. <Fig. 21> 3000 Chinese characters in Japanese writing are ready to be inputted on the drum of System C.

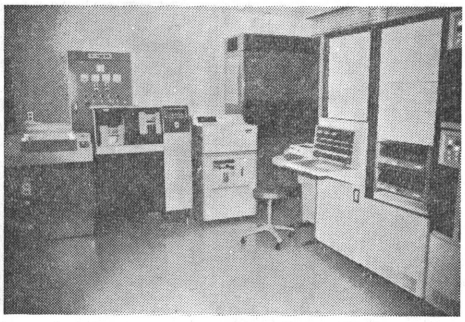
System B is designed for batch processing. At present, a local batch processing is being executed; punch cards and mark cards are taken as input media, and the output is received through a line printer. <Fig.22> A remote batch processing is also planned for the future. System A and System B can

share a file and it is possible to examine the way of data processings by the use of TTY or Display.

<Fig.21>

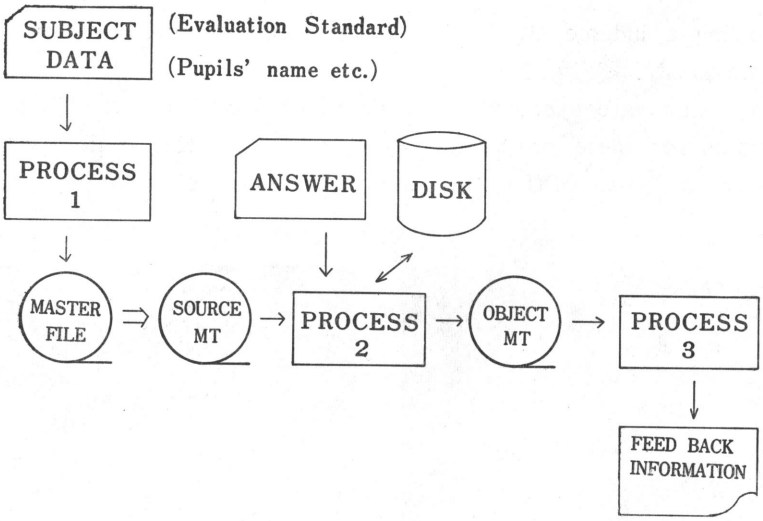


<Fig.22>



So far we have given a general description of the system itself. The actual state of data processing now under way, are as follows. <Fig.23>

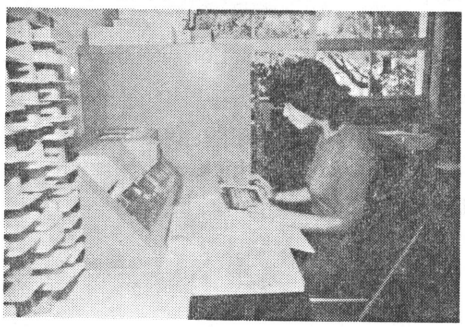
<Fig.23>



1) Punching out the evaluation standard, in other words, the criterion for judging pupils' answers to every check point in a classroom teaching program. <Fig. 24>

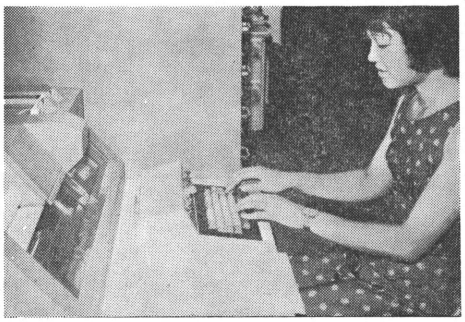
2) Punching out the names and sexes of the subject pupils, based on the class lists of the pupils. <Fig.25>

<Fig.24>

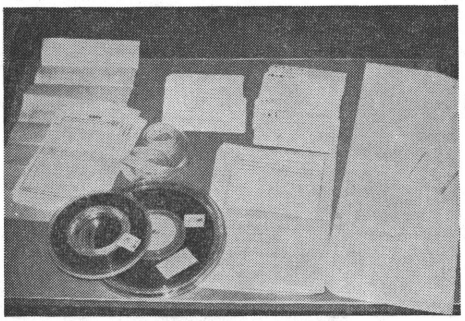


3) Inputting punched cards mentioned above into MT and then the master file to be completed in PROCESS 1, in advance. <Fig.26>

<Fig.25>



<Fig.26>

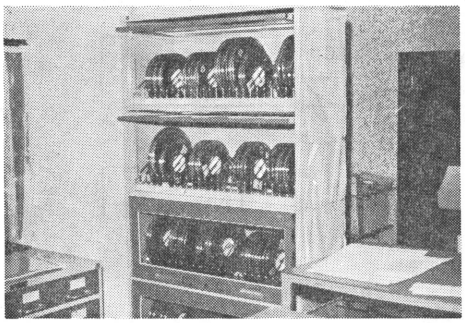


4) Inputting through, for the time being, a card reader the data of pupils' answers which are collected by a response analyzer or mark cards then transmitted by telex or by mail day after day as the classroom works go on.

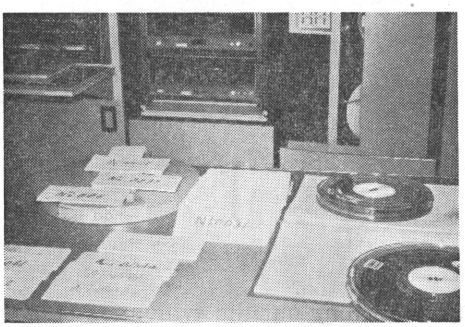
5) Processing a judgment on each answer according to the criterion stored in MT previously. <Fig.27>

These processings are executed by a disc operating system. That is to say, the programs for these processings are stored in a disc as library programs, and they are loaded to CPU by monitor cards then practically used. <Fig.28>

<Fig.27>



<Fig.28>



Here, the question is in what form the data of the results of classroom works should be filed in MT. <Fig.29> shows the tables which have been tentatively constructed during our investigation. And <Fig.30> shows an operating flow chart which was drawn for the purpose of debugging the errors of the data under operation.

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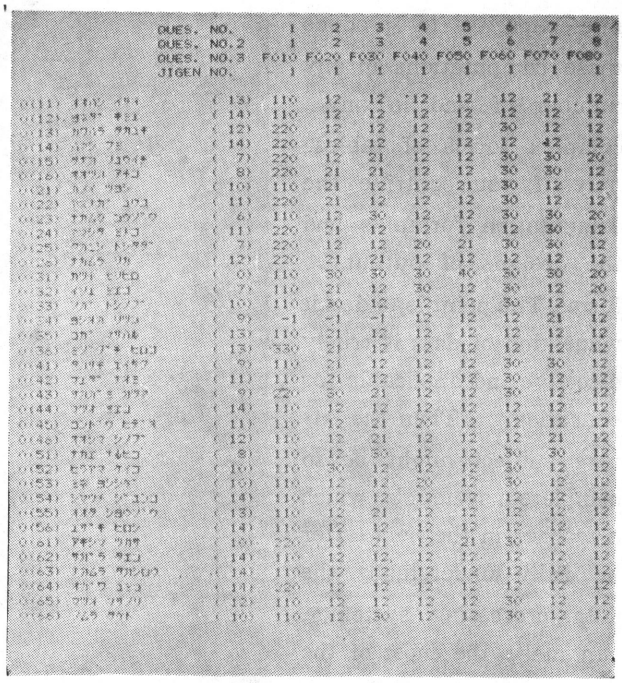
The other most important question is in what form the data accumulated and recorded in MT should be fed back to the field teachers. Therefore we, first of all, have to write and accumulate such programs as we can use to convert the data into various forms. A series of programs from NI 0041 to NI 0046 were written for this purpose and with these programs we can freely get any data in any desired form just by inputting the necessary items: the subject, school name, class, lesson unit, question number, diagnosis section number in question, and inputting a program for extracting a proper table.

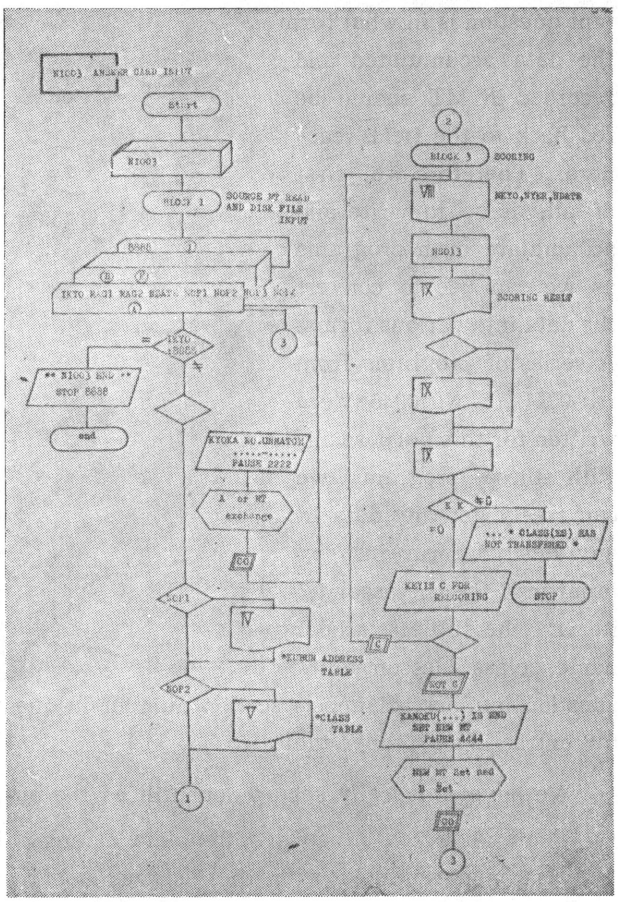
<Fig.29>



We have practically set up and utilized the output tables, as follows:

1) Table A which illustrates the data arranged by individual pupils with raw data being marked with the judgments of correctness by three grades: *, +, −.
2) Tables A11, A12, and A13 give the above results rearranged in order of high-scored pupils, and in order of high-scored questions.
3) Tables A21, and A22 give the above scores accumulated within each diagnosis section and their percentage indication.
4) Table A31, and A32 give score results in a form arranged by viewpoints.
5) Table B shows the data arranged by questions.
6) Table C presents a correlation matrix of the questions.
7) Table D indicates frequency distribution of the scores, the average marks, and standard deviation, accumulated within each diagnosis section.
8) Table E gives the computation results of entropy and redundancy.
9) Table F treats the factor analysis.

<Fig.30>



A computer has an infinite capacity to produce these computations in any number of and in any complex forms of tables, only if you contrive the computation formulas and the designs of output forms. The point is to decide what kind of data is truely effective and applicable for education. Then the future subject might be to complete a system by which a teacher in the field, after he fully understands the data processing system, can make the most of the "Synthetic Information Processing System of Isolated Islands' Education", using on-line or on-call mode at each terminal of the data communication network and can obtain the data in a form appropriately selected.

PART II

[A] CLASSROOM LEARNING-TEACHING; "NIGHT" SYSTEM ENGLISH COURSE

Nagasaki University
Yutaka SOEDA
Chizuko SUZUKI

This paper presents a general survey of our main purpose; that is, the writing of the English learning programs, what they are about, and what we should do to improve them in the future. It also illustrates the experimental classes so far administered on a few remote islands, and some of the findings in the data processing.

The main purpose of our English learning programs is to familialize the junior high school pupil with spoken English of natural speed and intonation, and, if possible, to enable him to produce the same kind of English. During the past two years, we have written six programs, each concentrating on a particular syntactic unit: 'Be as copula', 'Regular Verb', 'Progressive Form of Verb', 'Comparison of Adjectives,' 'Passive Voice', and 'Present Perfect Tense'. All programs are recorded on tape, but we found that the teacher in charge is extremely important, because it is for him to decide when and how to use the programs in his teaching schedule. In this connection, we attached to each program a teacher's guide to such phonetic variations as assimilation, nasal explosion, lateral explosion, etc. Experience has shown the impossibility of giving a clear picture of a flow of speech without first realizing and practicing these variations. In our opinion, there are few, if any, units involved in the production and perception of speech which correspond to phonemes, so it is no wonder that phoneme-dominated exercises have failed to enable the student to perceive English speech clearly when spoken at natural speed. The difficulties that phonemes tend to present may be called 'static', but speech tends to raise a lot of 'dynamic' difficulties. In still other words, overcoming static difficulties never guarantees understanding speech correctly.

The pupil is supposed to respond to the recorded stimuli and, at the end of each section, his achievement is to be checked. The programs are from 15 to 30 minutes long, and taped on a real-time basis, so that the teacher does not have to do anything but give instructions.

It is hoped that data from the classroom will be able to both serve as input

to theoretical discussion and, after evaluation, as feed back to the design of remedial curricula.

We have analyzed the above mentioned teaching programs, the aims cf which were to improve the present teaching programs and to extract information which would be helpful in making individual learning programs. The analysis was accomplished by evaluating the nature of the students' mistakes after they had been processed through the NIGHT system EDPS. It is hoped that we will be able to verify our methods of analysis and evaluation so that they can be included in future teaching-learning programs.

The materials of teaching programs subject to this analysis are Program (7801) and (7802) : (7801) =Regular Verbs, K (1) – (3) and (7802) = 'Present Progressive Forms', K (4) – (6) for the 7th-year students. Each k-code test deals with the following point respectively : K (2) verbs of present tense for the 3rd person singular subjects, K (1) those for the other subjects, K (3) all-round problems of verbs, K(4) how to make present progressive forms, the affirmative sentences, K(5) the negative and interrogative sentences of present progressive forms and the application of them, lastly K(6) all-round problems of present progressive forms. The names of the schools cooperating in the experiment and the number of the classes and the students for each test are given in Table 1.

In order to get a score for each question, we used the NIGHT system EPDS to take an average score for each question made by the sum total of all the students participating in the experiment. Table 2 lists these scores. Next, among the sixty questions in Table 2, we considered those with socres of less than 50 (marked with an asterisk) to be problem questions. Thirdly, we investigated the nature and the cause of the mistakes of the problem-questions with multiple choice answers by pointing the incorrest answers chosen most often by the students and analyzing the reason(s) for their choice. Finally, for those questions without multiple choice answers, we examined the nature of each question referring back to the teaching-learning program.

We may summarize findings of the analysis as follows, mainly from the viewpoint of students' learning conditions.

1) The concrete purpose (I) of a lesson unit is mostly to make students able to exchange questions and answers in a given situation using the pattern in question. Nevertherless, the students could not actually get good marks in the problems concerned with questioning and answering. This is in strong contrast to the scores they got on transformation of sentence types 〔K(2)4–8, K(4)1–7, K(5)1–4; the average score is 63%〕 and English

composition, the latter of which is generally regarded as a difficult problem [K(1)6−10, K(2)9−10, K(3)6−10; the average score is 59%[1)]]. Three examples follow:

i) In a problem that required students to choose a correct answering form to the question form "Does your mother like lemons?", more than 40% of the students (while 23% of them could answer correctly) seemed to have no idea of adding an affirmative statement like "She likes oranges" after a

Tabl 1

SCHOOL \ K	K (1)	K (2)	K (3)	K (4)	K (5)	K (6)
Hiradochubu	1 / 38	1 / 38	1 / 38	1 / 38	1 / 38	1 / 38
Shimizu	0 / 0	0 / 0	0 / 0	1 / 42	1 / 42	1 / 42
Numazu	1 / 43	1 / 43	1 / 43	0 / 0	0 / 0	0 / 0
Shimabara	4 / 170	4 / 170	4 / 170	4 / 170	4 / 170	4 / 170
Kuchinotsu	4 / 176	4 / 176	4 / 176	0 / 0	0 / 0	0 / 0
TOTAL	10 / 427 ques.9,10 6 / 251	10 / 427	10 / 427 ques.9,10 6 / 251	6 / 250 ques.10 5 / 208	6 / 250	6 / 250

no. of classes / no. of students

Tabe 2

ques. \ K	K (1)	K (2)	K (3)	K (4)	K (5)	K (6)
1	52.2	*41.5	*34.9	80.0	56.0	66.4
2	92.7	*23.4	*34.9	56.4	*42.4	54.0
3	75.4	*42.4	*41.9	*49.6	51.6	68.4
4	*45.7	53.2	*24.4	80.0	53.2	58.0
5	89.2	75.8	*36.1	76.4	*26.0	54.8
6	*47.3	51.4	*45.9	66.8	64.0	*47,6
7	88.3	72.9	*49.1	77.2	*41.2	*33.6
8	*48.9	63.7	*47.7	84.4	*37.6	*24.8
9	90.8	53.4	76.1	93.4	56.8	50.8
10	91.7	*49.4	82.9	92.4	*37.2	92.8

negative short answer, "No, she doesn't", and chose a typical form in which a negative full form statement follows mechanically after a negative short answer, like "No, he doesn't. He doesn't like lemons.", in spite of the incorrectness of the subject pronoun.[2] Though it partly depended on the fact that such an answering pattern was not introduced in the classroom teaching-learning program, this suggests that students stick to a memorized pattern without listening carefully and comprehending fully the content and meaning of questioning and answering sentences. 〔K(2)2, K(3)2〕

ii) Students tended to use "Do you ……?" for all questions and "Yes, (or No,) I ……." for all answers. In another problem, in which they had to choose a correct question form to a given answer, more than 20% of the students chose "Do you play tennis?", to an answer "Yes, she does. She plays tennis." ; the correct form "Does your sister play tennis?" was chosen by 35% of the students, while 40% of them could give no answer. This appears to be subject to the influence of the difficulty of changing pronouns that will be discussed next. And in a relatively simple and basic problem that required them to choose a correct answer form to the question "Does she like dogs?", the ratio of the students who answered "Yes, I do. I like dogs." amounted to 25%, with only 40% correct. 〔K(2)1, K(3)1, etc.〕

iii) In a dialogue, while exchanging questions and answers, the students were required to change nouns to pronouns. But they could not do this properly. This can be exemplified by the above K(2)1, K(3)1, etc. Besides, in a problem requiring them to choose a correct answering form to the question "Do Tom and May skate every day?", the students who chose "Yes, he skates every day." were equal in number to those who answered rightly, or 30% of the total for each group 〔K(1)4, K(2)2, K(3)1, K(3)2, K(5)8, etc.〕

2) In a comprehension test, the scores of problems of questioning and answering in English were generally low or about 35. 〔K(6)5, 6, 7〕

iv) As we said before, in the problems in which mechanical transformation of sentence types is required; for example, from a given affirmative sentence to an interrogative or a negative sentence, the average score of all such problems is high, that is, 63%. Among them, however, transformation to an interrogarive sentence seems a little more difficult (60%) than that to a negative sentence (69%). 〔K(2)4−6, K(2)7, 8, etc.〕 And further, the

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1) In this case, correct answers include correct repetetions after a model.

2) In this problem, the poorness of hearing distinction between "he" and "she" also seemed to have the effect of lowering the score. (cf. the following iii)

alternative question type was much more difficult and was mastered by only 36% of all the students. [K(3)5]

3) A few more phenomena were observed. One is that when noun modifiers followed one after another as in "my new pen", or there were more than two noun modifiers in one sentence as in "my mother doesn't like this camera", less than 50% of the students gave the right answer. The other is that in the case where a sentence was long and composed of more than 8 words, the score dropped sharply to 37%, probably due to the students' memory span. [K(1)8, K(2)10, K(5)10]

Our analysis revealed weaknesses in our teaching-learning programs and a lack of coordination between them and the tests made for them. We now have to decide whether to expand our present teaching-learning programs or change our present tests and make more programs to introduce the missing information at a later date.

It may be concluded that our methods of analysis are valid enough to grasp the general tendency of a group of students and to diagnose and evaluate a classroom teaching-learning program at least. It is, however, still open to question how much they can contribute to framing and improving an individual learning program; we may have to set up independent methods of analysis for diagnosis and evaluation of an individual learning program.

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〔B〕 DEVELOPMENT OF INDIVIDUAL LEARNING MATERIALS; A STUDY ON "NIGHT" SYSTEM SOCIAL STUDIES LEARNING

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This is a paper on the development of individual learning materials for social studies. We have approached the problem from two main points of view. One is that we need to make clear and accurate the concepts relative to the development of individual learning materials, and the other is that we need to clarify the fundamental thinking of social studies education.

Now, let us discuss the details below.

(Ⅰ) The Concepts of Personalization and Individualization

Briefly speaking, individualization is a means for attaining personalization. That is to say, the individualization of learning-teaching is one of the effective means which help each individual pupil develop his personality fully and help him display his possibility completely.

(Ⅱ) Three Fundamental Learning-Teaching Forms

(1) The lecture learning-teaching form: the teacher is supposed to teach many pupils the same content at the same time.

(2) The group learning-teaching form: pupils are guided in their study with a close relationship among themselves.

The "Group" learning-teaching form: by this "group" we mean a means for helping each individual pupil to develop his possibility to the full.

The "Group doctrine" learning-teaching form: this "group" here is something prior to an individual.

(3) The individual learning-teaching form: each individual pupil is guided in his study of his own initiative.

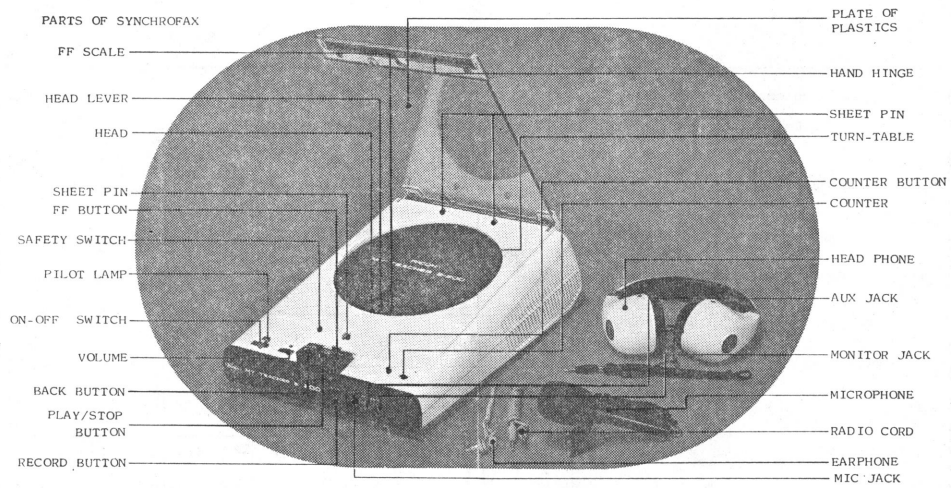
(Ⅲ) The Learning-Teaching Formulas

In the learning-teaching formulas, there are "das Exemplarische Verfahren" (the example formula), the heuristic learning, the investigating learning, the spontaneous co-operation learning, the programmed learning, and so on.

(IV) Instructional Media for Individual Learning

In using instructional media, it is necessary that we should fully consider their properties——the functions and uses——, and that we should improve the efficiency of learning-teaching by combining them organically.

At present, we are mainly using Synchrofax as an instructional medium for the individual learning in the "NIGHT" system. Synchrofax, a trade name, is a medium which is capable of recording and reproducing recorded audio information from an audio sheet having a magnetic oxide coating on one side. Synchrofax has a Stop/Start button so that the operator may stop and restart at any point in the course of the reproduction from the audio sheet. Synchrofax is equipped with fast forward and reverse controls and with an integral counter so that each audio sheet can be randomly searched for information. Thus the ideal learning arrangement of one teacher-one pupil is now possible through the use of Synchrofax. Suitable either for use as an aid in the increasingly crowded schoolrooms or for private home study, Synchrofax permits the double impact of sight and sound to get the message through——clearly and indelibly. We are making programs and editing both visual and audio information.



In view of this, we can say that, in order to make the individualization of learning-teaching more concrete and sure to approach true personalization, we have to investigate fully the learning-teaching forms as the conception of means, the learning-teaching formulas as the conception of means, the media to raise the level of efficiency, and so on, and have to connect and unify those most suitably and organically, and at the same time we have to develop and prepare the most suitable learning-teaching program and material to develop each per-

sonality plentifully.

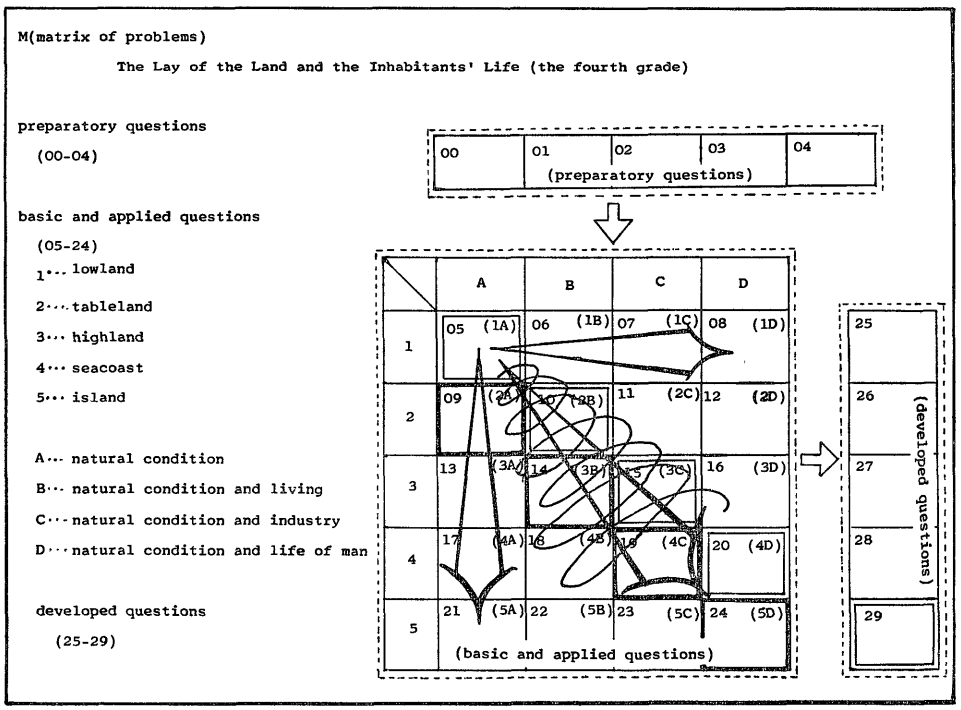
(V)　The Individual Learning Materials for Social Studies

The individual learning materials of the "NIGHT" system consist of M (matrix of problems) and N(package of module).

1. M(Matrix of Problem)

It arranges various problems suitable for pupils' abilities, aptitudes, interests, concerns, and so on in relation to ease, difficulty, and content. And we made its structure simple and showed the main flow in the sequence of problems with arrow marks for not only teachers but also pupils in order to enable them to choose suitable problems spontaneously and independently.

The problems consist of preparatory, basic, applied and developed questions. Now, let us take up the matrix of problems in social studies learning, and particularly mention the main idea. We rearranged "the matrix of problems in social studies learning" (100 questions) and "A drill book of social studies learning" (100 questions), both based on "The Lay of the Land and the Inhabitants' Life" (a unit title) for the fourth-year children of primary school and we made a matrix consisting of 30 questions to be used on the sheet. The table below illustrates this.



(a) The preparatory questions (00-04) of this unit are such as to enable pupils to acquire the foundational matters of basic and applied questions, and to obtain the basic thinking faculty of how to look at things. Then, we mainly made the questions relative to the basic parts of the abilities and skills with which pupils can make the best use of materials.

(b) The basic and applied questions (05-24) are such as to enable pupils to master the fundamental matters, how to look at society, and the questions are intended to be applicable, too. To put it a little more concretely, we set up a matrix with five rows and four columns of the basic and applied questions, in each row of which we arranged the questions according to an areal condition, and in each column, we arranged the questions according to a relative condition of nature and human beings. And the questions in each row develop themselves in the profundity according to the conditions of columns, and as for the questions in each column, they develop the profundity according to the conditions of rows. We set up the questions so that they could help pupils to deepen, expand, develop the viewpoint and way of thinking on each part.

(c) The developed questions (25-29) are the questions developed from the basic and applied questions. Our main purpose was to make the kind of questions that were likely to enable pupils to acquire the compound, synthetic, structual viewpoint on and how to look at society, and at the same time to approach the real problem-solving. Number 25 is the question of developed unity of basic and applied questions concerning the natural condition, number 26 is the question of developed unity which relates to the natural condition and the living, number 27 is the question of developed unity which relates to the natural condition and the industry, number 28 is the question of the structural and developed unity which relates to the natural condition and the life of man. Moreover, number 29 is concerned with the discussion method. Number 29 aims at making pupils find out especially the subject about the nature and the life in a real concrete area, and to solve it. But we do not require them to reach a clear and accurate solution. The point we considered in this question is as follows. The question raises pupils' volitions toward the next step, and cultivates their attitudes with which they always approach to the reality, by having them foster the question as it is.

Considering the feature of social studies education, that is, sociality, co-operation and solidarity are put stress on in it, we have added especially the

discussion method to the individual learning materials. The essence of the discussion method is that all pupils improve the group-thinking and the co-operative thinking by exchanging freely and positively their views, knowledge and experiences among themselves. That is to say that they find out the beginnings of problem-solving with full personality in co-operation and raise the motivation of independent learning by expressing freely their well-founded opinions in the equal position and by drilling one another.

(d) The questions with double frames and black frames are the main questions that we regard as most important.

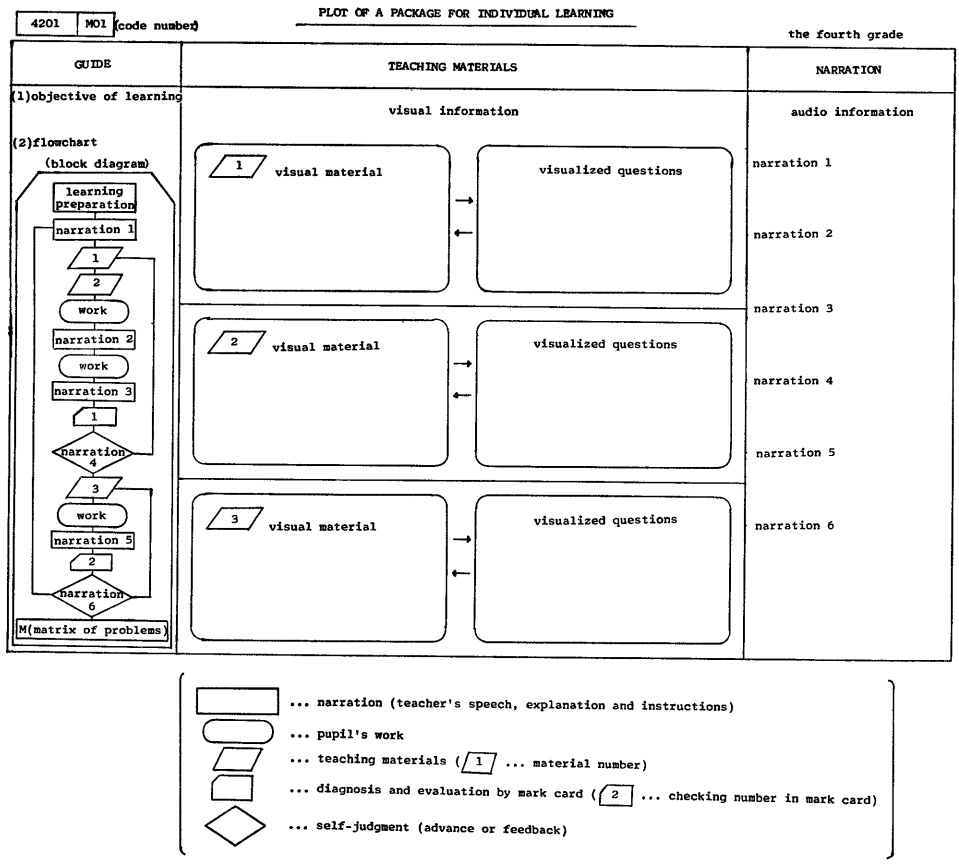
(e) On the M(matrix of problems)in social studies, we have roughly showed the main stream of the sequence of problems with arrow marks. It is because that social studies education aims at the formation of man who can solve the social problems independently. And so, pupils must face up to the realities of social life and must grasp the beginnings of problem-solving through considering the various social phenomena and must solve the problem independently and rationally. Therefore, on the M (matrix of problems) in social studies, we did not put the instructions and arrow marks as "if you finish this problem, go forward to the next problem" as in a very logical and systematic school subject. However, we have shown the rough direction with arrow marks in oder to let pupils make good use of time.

Moreover, it is necessary to reorganize this M (matrix of problems) and, without thinking it as fixed, to fully consider the actual conditions and the environments of pupils' life, and the situation of local society. The reason is that it is important to assure the development of pupils' understanding through M's revision, addition, deletion and reformation, for example, rearranging the sequence of lowland, tableland, highland, seacoast and island in the row side of this M (matrix of problems), considering locality fully, into island, seacoast, lowland, tableland and highland.

2. N (Package of Module)

It means a unit of package which supplies, as a set, a magnetic sheet having visual information and audio information, a mark card and a learning preparation (a print for the use of pupils) for an individual question in matrix of problems. Each pupil can learn alone with the package that he selects from a matrix of problems according to his personality, possibility, interest and concern. And he can check in a mark card the progress and the result of his learning by himself. In making of packages, we tried to make them help each individual pupil develop his personality fully and accord with a variety of pupils. And moreover, we aimed at forming an attitude in which they learn independently.

Example of N (Package of Module) in Social Studies Learning



3. Diagnosis and Evaluation of Individual Learning by Mark Card

(a) A teacher not only improves his classroom teaching based on K. R. (knowledge of results) information but can guide an individual pupil pertinently, checking up with subjective observation result in everyday classes.

(b) The results of individual learning on M (matrix of problems) and N (package of module) are checked in mark card and processed by EDPS. They are also fed back to teachers and preserved as Cumulative Record Information.

Data which are cumulatively preserved as above are to be analyzed at proper time in order to evaluate the progress and development according to several evaluation checkpoints.

Conclusions

We have so far carried out our consideration on the development of individual learning materials for social studies, from the two main points of view. Here, what I want to say in addition is that in respect of the learning-teaching, only from the side of individualization we will not be necessarily able to attain our ultimate objects: to develop each pupil's personality fully, to bring up his creativity and sociality, and to make each pupil's potentialty come into full bloom, and conducting the learning-teaching only in terms of individualization from beginning to end is not always successful. The real personalization we are aiming at will be able to be accomplished only when the following two aspects are co-ordinated: one is the aspect of grouping, that is to say, a pupil can be more personalized in group-thinking or co-operative thinking through realization of his own position and his own frame of thinking and besides through training among the group members, and the other is the aspect of individualization, that is, from the viewpoint of respecting personality, and making each individual pupil fulfil himself, each pupil's personality should be cultivated by developing and preparing such kind of learning-teaching programs and materials that will be appropriately suited to every pupil individually.

Then, first we will have to encounter a great important problem of how to co-ordinate and complement the two aspects organically; to say more concretely, with regard to the learning-teaching forms, group learning or classroom learning by groups and individual learning by individuals, and with regard to the learning-teaching programs and materials, the programs and materials for group or classroom learning and those for individual learning, because as I mentioned before, each form of group learning, classroom learning and individual learning has its own independent theories and rules, and the programs and materials for each learning form which have been developed and constructed based on its form have their relatively independent theories and rules.

Therefore, let me conclude this paper by clarifing that in developing and constructing the programs and materials for group or classroom learning and individual learning, we must pay our attention exclusively to the following points: one is that it is indispensable to develop and construct them after fully understanding the relatively independent theories and rules and this leads us to the truth that we should outgrow our conventional thought that the programs and materials for individual learning are to be designed for just supplements of group or classroom learning programs and materials. The point is that the programs and materials for group or classroom learning and those for individual learning have to be made as completed construction relatively independent of

each other. Furthermore, even if you use only either the programs and materials for group or classroom learning or those for individual learning, you will be able to attain the objects and aims of the lesson unit in question, and the programs and materials should be made as such. The other point is that the programs and materials for every form of learning as a relatively independent and completed construction having their own relatively independent theories and rules, must be developed and constructed in such a way as to be always co-ordinated and complemented organically, with any part being freely selected and utilized at any time in a dynamic and flexible way according to the actual conditions of each pupil, for the purpose of developing each pupil's personality fully, bringing up his creativity and sociality, and making his potentiality in full bloom.

In short, the programs and materials for each form of learning should be developed and constructed as having an independent completed construction, in due consideration of their relatively independent theories and rules, and at the same time we have to make them in such a way that they can be organically complemented and co-ordinated.