

A general theoretical framework for individualized instruction*

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Introduction

In several countries several patterns of adapting instruction to individual differences have been designed and applied to real school situations.

Examples are the Individualized Prescribed Instruction Program of the Learning Research and Development Center at the University of Pittsburgh, the I.M.U.-project in the Swedish comprehensive school, setting in the U.S.A. and several Western European countries, the Schagen-project and the Roncalli-system in the Netherlands, and so on.

The different patterns of individualized instruction are developed from different points of view. However, some general theoretical framework is necessary in which these different points of view and the resulting different models of individualized instruction can be placed and from which other possible models can be derived. It is the purpose of this paper to develop such a general theoretical framework.

In dealing with the problem of developing a general theoretical framework for individualized instruction, first of all it is necessary to analyze school learning and to determine the factors involved in it.

This is a subject of part 1.

On the basis of this analysis and the resulting model for school learning, in part 2 a general theoretical framework has been developed from which can be derived the different possible pat-

terns or models of individualized instruction.

Part 3 deals with these different patterns of individualized instruction.

1. Individualized instruction and a model of school learning

1.1. Definition and aspects of school learning

School learning can be defined as placing the learner in an intentionally created learning situation (the instructional situation) to bring about some intermediate behavior in the learner by which some specific aspect of the learner's entry behavior is being changed into some desired terminal behavior.

School learning can be considered in relation to an entire course, but also to a much smaller unit, the so called learning unit or learning task*.

According to the definition above school learning refers to *five major aspects*:

1. the entry behavior of the learner
2. the behavior-to-be-learned
3. the instructional situation
4. the learner's intermediate behavior or way of learning a task as the result of the permanent interaction between learner's entry behavior, instructional situation and behavior-to-be-learned
5. the outcomes of pupil's intermediate behavior or the learner's achievement.

The *entry behavior* (the behavior with which a student enters a particular instructional situation) is the complex behavioral pattern which is the result of the long-term and short-term history of

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the learner. It consists of:

1. cognitive entry behavior (this is what Glaser (1967) means by the term entering or entry behavior), including:
 - the extent to which the student has already acquired what is to be learned.
 - the extent to which he has the prerequisites for learning the behavior-to-be-acquired, including *specific* prerequisites, for example knowing how to add before learning to multiply, and more *general* prerequisites, that is to say the developmental stage or age of the learner (Havighurst 1952, Bloom 1964).
 - the learning characteristics of the pupil, reflecting his general and specific abilities and previously acquired learning skills.
2. psycho-motoric entry behavior.
3. affective entry behavior.

The affective behavior can be divided into (Bloom, 1971):

- the learner's interest for the subject to which belongs the behavior-to-be-acquired, or his attitude to school and school learning in general.
- the academic self-concept of the learner, meaning the learner's notions about his competence with the subject (specific class of learning tasks) or school learning in general.
- other deeply seated personality characteristics relevant for the concerning learning process. For example the learner's ability to overcome difficulties in learning, nature and frequency of reinforcement he needs, the learner's sensitivity for sources of extrinsic motivation (expectations of the parents or the teacher, stressed competition and so on) etc.

The behavior-to-be-learned (or the objectives of learning) forms (or ought to form) the content of instruction. Some evaluation specialists (a.o. Bloom, Hastings and Madaus 1971) think it useful to define the behavior-to-be-learned in relation to subject matter or content, meaning the way of acting, thinking or feeling about the subject matter.

However, often the subject matter is only a

means to bring about some desired behavior in the student and consequently behavior-to-be-learned cannot be related to some specific subject matter. This seems to be the case in modern foreign language education by so called direct methods. This seems also to be the case with programs, which are arranged to bring about some general skills such as learning skills, or some general attitudes, for example positive attitude to learning or some positive self-concept.

Some major aspects of *the instructional situation* are:

1. the personality of the teacher and the way he is handling the group learning situation.
2. the way in which the teacher introduces the task foregoing the proper learning of the task.
3. the starting point of instruction, that is to say the level of prerequisites for learning the behavior-to-be-learned and level of behavior to be learned on which instruction is starting. For example, does teaching start entirely at the beginning or at some later stage of the behavior-to-be-learned?
4. time allowed for learning the behavior-to-be-acquired.
5. method of instruction, including materials, used in teaching the task.

The learner's intermediate behavior or way of learning a specific task includes all the activities the student is performing to enable him to reach mastery of the desired terminal behavior.

In school learning the learner's entry behavior, the behavior-to-be-acquired and the instructional situation interact in a way to make the developing of student's intermediate behavioral pattern a very complicated process.

In the remainder of our discussion school learning refers to the learning of a learning task.

One way of describing the very complicated process involved in learning a task is to go out from the final product of pupil's intermediate behavior, namely his *degree* of learning, and to define the factors involved in producing a specific degree of learning. This for example is the approach of Carroll (1963).

In his model of (cognitive) school learning Caroll takes the factors, involved in producing a specific degree of learning, as time variables, and then states the following relationship:

$$\text{degree of learning} = f \left(\frac{\text{time actually spent}}{\text{time needed}} \right)$$

that is to say degree of learning is a function of the ratio of the time actually spent in learning to the time needed. In these time variables you can put all the variables, concerned in producing individual differences in degree of learning.

For our purpose, we shall try to describe the school learning process by analyzing the factors determining the learner's way of learning a specific task.

The learner's achievement. We have to take in mind that the degree of learning is measured by some test or other measurement instrument, and it is the test score which informs us about the degree of learning. So the learner's achievement depends on his degree of learning *and* the methods and instruments used in measuring this degree of learning.

1.2. Some basic conditions for learning to take place in the school

Whether the degree of learning-indicated-by-some-testscore will be satisfactory depends on some basic conditions of the school learning situation (see figure 1).

1. The behavior-to-be-acquired has to fit into the learner's entry behavior. For example the objectives should be reconciliable with the learner's developmental stage (Havighurst 1952). When it does not, learning of the

desired behavior will be insufficient or nihil. In this case the objectives should be redefined.

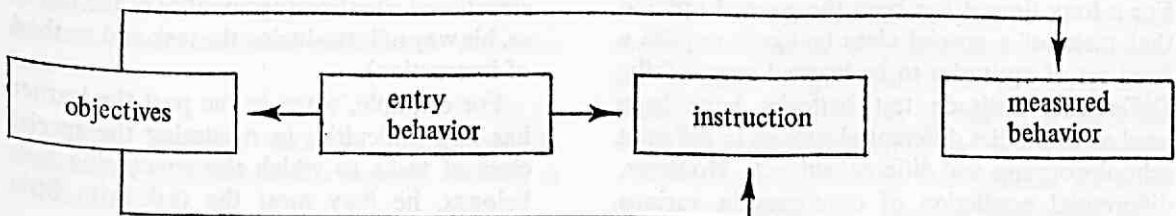
2. The instructional situation should be arranged in such a way, that the behavior actually taught is the same as the desired behavior (when we teach knowledge of facts, while the desired behavior is comprehension, behavior actually taught does not correspond to the desired behavior). When this is not the case, the instructional situation should be changed, or if this is not possible, the objectives should be redefined.
3. The instructional situation ought to be in agree with the entry behavior of the learner. The less this is the case the less learning of the behavior-to-be-acquired will take place.
4. The measured behavior should be the same as the behavior-to-be-acquired, that is to say that the measurements used ought to have validity in respect to behavior-to-be-acquired. In fact, norm-referenced measurement does not have validity in respect to behavior-to-be-acquired.

1.3. Developing a model of school learning

What factors determine pupil's way of learning a specific task?

1. One of these factors are the specific characteristics of the task to learn, including abilities involved, learning skills involved, level of prerequisites and level of behavior-to-be-learned from which the task starts.
2. Another factor is pupil's level of the abilities involved in learning the task. When for example the task places maximum demand on

Fig. 1 Some basic conditions for school learning



spatial abilities, for successful learning the pupil should score high on a spatial ability test.

3. A third factor is student's acquired level on the behavior-to-be-learned and on the pre-requisites for learning the behavior-to-be-learned.
4. A fourth factor is student's acquired level on learning skills involved in learning the task.
5. A fifth factor is pupil's perception of and subjective feelings towards the task (difficult, attractive, useful, a challenge?).
6. A sixth factor is the arrangement of the instructional situation (instructional method and so on).

The factors mentioned above are in no way isolated factors, but are closely related.

For some factors this relationship may be clear. For example, pupil's perception of the task depends partly on the characteristics of the task, and partly on his affective entry behavior. Another example: the arrangement of the instructional situation interacts with pupil's perception of the task. When for example the teacher introduces the task with sentences as 'I give you enough time to finish this task' or: 'Let us see which pupils perform best on the task' (so stressing competition), pupil's perception of the concerning task may be influenced. Reversed, the teacher may change the instructional method when the pupil verbally expresses his perception of task-difficulty. And so on. Some recent discussions refer to relations which until recently have not been dealt with. We shall consider these discussions in the following paragraph.

Differential aptitudes and successful learning in different subjects.

For a long time it has been the general opinion that tasks of a special class (subject) require a fixed set of aptitudes to be learned successfully. Differential aptitude test batteries have been used as to predict differential success in different schoolprograms and different subjects. However, differential prediction of outcomes in various

educational programs by differential aptitude batteries has hardly been successful (Glaser 1970).

Outcomes of recent factorial studies of the changing composition of involved abilities over the course of learning a subject (a.o. Fleishmann 1965, McKenna 1968, Carver and Du Bois 1967) suggest that the aptitudes required for success in learning varies as one gets farther into particular subject matter. However, this variation is not all too big: the abilities involved in the first task of a sequence of learning tasks continue to make up about 80% of the abilities involved in the succeeding tasks and the *new* abilities involved in every task makes up only about 5% of the total set of abilities involved.

Besides the outcomes of the studies of Fleishmann a.o., outcomes of studies dealing with correlations between different abilities and different ways of learning (a.o. Gagné 1967) suggest, that different instructional procedures require different sets of abilities. So the abilities required may be very specific for a *specific task* learned under a *specific instructional procedure*.

A model of school learning

The model outlined here (see figure 2) is based on the following relationships:

1. the specific characteristics of the task are determined by:
 - the objectives of learning and
 - the instructional situation (starting point of instruction and method of instruction)
2. pupil's set of entry behaviors involved in learning the specific task depends on the task characteristics.
3. pupil's perception of the task is determined by his affective entry behavior, the specific characteristics of the task, and the instructional situation (personality of the teacher, his way of introducing the task and method of instruction).

For example, when in the past the learner has had difficulties in mastering the special class of tasks to which the concerning task belongs, he may meet the task with little

confidence and perhaps negative feelings.

4. The more instable aspects of pupil's affective entry behavior (as the results of the short-term history of the learner) may be influenced by the instructional situation which the pupil enters (personality of the teacher, the way in which the teacher introduces the task and the method of instruction). For example, a pupil's negative feelings towards geography may change when another teacher with another personality teaches the task.
 5. Level of pupil's cognitive entry behaviors involved in the specific task under consideration (level of abilities involved, acquired level of the prerequisites, acquired level of the behavior-to-be-learned, level of learning skills involved) and his perception of and subjective feelings towards the task determine the way in which the pupil is learning the task.
 6. The way of learning determines pupil's achievement.
 7. The degree in which the behavior taught includes learning of better ways of dealing with the special class of tasks, to which the task belongs, influences relevant cognitive entry behavior at the following learning task.
- Achievement (successful or not successful) influences affective entry behavior at the following learning task, and in the case of highly sequential learning tasks, also the relevant cognitive entry behavior.

The model outlined here (see figure 2) shows the factors determining the way in which the pupil is learning the task. When this way of learning is not a very successful one, those factors can be easily isolated which can be manipulated to improve pupil's way of learning.

2. *A general theoretical framework for adapting instruction to individual differences in entry behavior*

2.1. *School learning variables which can be manipulated to affect pupil's way of learning a specific task.*

Considering the model of school learning outlined in part 1 we can easily detect the major variables which can be manipulated as to improve pupil's way of learning a specific task. One possibility is to change the learner's entry behavior by *compensatory education*. There is evidence (Bloom 1964, Hunt 1961) that aptitudes may be modified by offering the child specific learning experiences, likely most markedly during the infant and early elementary school period. In later school years probably only that cognitive entry behavior can be affected markedly, which is the result of the short-term learning history of the pupil (learning skills and *specific* prerequisites for learning a special class of tasks or subject).

The other possibility is to adapt instruction to individual differences in entry behavior as to maximize on the aspects of pupils entry behavior which are most highly developed.

These two possibilities are not necessarily separated. For example, by adapting the instructional situation to the individual characteristics of pupil's cognitive entry behavior as to enable the pupil to learn more successfully, pupil's affective entry behavior will be positively influenced (Bloom 1971).

Besides, in fact we have two tasks: capitalizing on the existing pattern of entry behavior and modifying this pattern (Cronbach 1967).

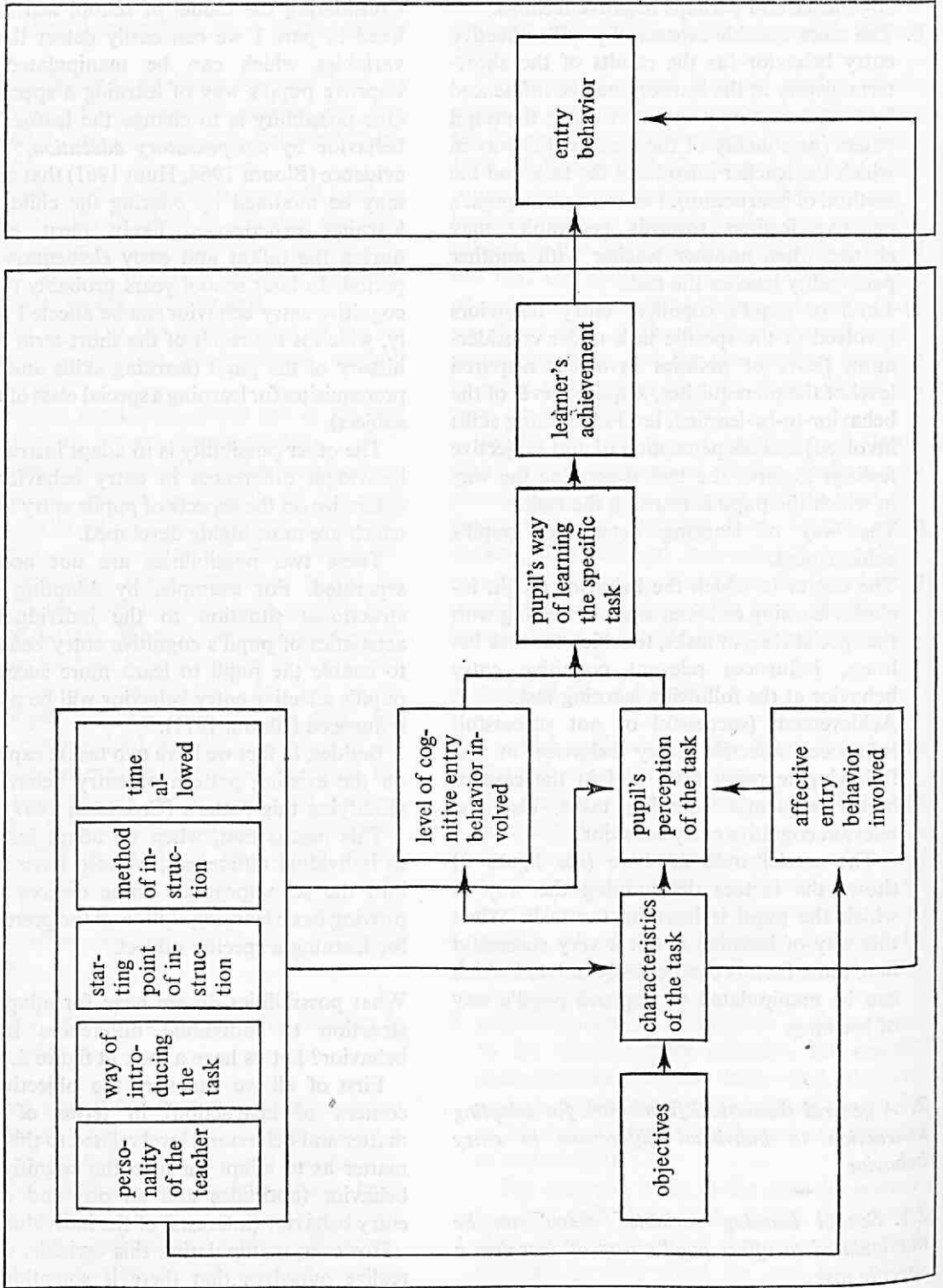
This means that, when we adapt instruction to individual differences, we also have to build into the schoolprogram some devices for improving basic learning skills and the prerequisites for learning a specific subject.

What possibilities do we have for adapting instruction to individual differences in entry behavior? Let us have a look at figure 2.

First of all we can vary the objectives (the content of instruction) in terms of subject matter and behavioral level related to this subject matter as to adapt them to the cognitive entry behavior (aptitudes and so on) and affective entry behavior (interests) of the individual pupil.

However, manipulating this variable, we must realize ourselves that there is something as a

Fig. 2 A model of school learning.
LEARNING TASK 1



basic school program, which every pupil should master. Once mastered this basic school program, the objectives should be flexible.

Secondly, we can vary parts of the instructional situation. These manipulatable factors of the instructional situation are:

– place in the sequence of learning experiences leading to some specified instructional outcomes, from which instruction is starting ('placement decision' to make on the basis of achievement information about every pupil) (Glaser 1971).

By varying this factor we can adapt to the extent to which the individual pupil possesses the prerequisites for learning the behavior-to-be-learned, and the extent to which he has already learned the behavior-to-be-learned.

– method of instruction ('diagnostic decision' to make for every pupil) (Glaser 1971).

By varying this factor we can adapt to pupil's acquired level of learning skills, to his level of general ability to learn (Glaser 1970) and perhaps to his differential aptitude pattern (Cronbach, 1967).

– time allowed.

2.2. *The current situation in school learning*

The current situation is characterized by what we can call *selective instruction*. Here objectives and learning situation are relatively fixed and inflexible. Individual differences are taken into account chiefly by dropping along the way those students, for whom the type of instruction is most unfavourable in respect to their pattern of entry behavior, and who so are not enabled to master the behavior-to-be-learned.

Besides, this *absolute selection* in terms of mastery and nonmastery is accompanied by a process of *relative selection*: by means of norm-referenced measurement of learner's achievements the learners are distributed in a normal fashion.

In practice it is by means of the resulting relative measurement score, that the learner's achievement is expressed: those who are above average have been successful, those who are

below average have been unsuccessful.

This normal distribution of learning achievements does not necessarily reflect the distribution of learning achievements in terms of mastery and nonmastery. Depending on the degree of difficulty of the learning task for a *specific* group of pupils, a specific level of mastery will be classified as successful or not-successful.

To a selection *during* the learning process is often added some selection *preceding* the concerning instructional learning process. The tests then used are specially constructed to predict the long term product of a learner, placed in the unfavourable situation of selective school learning (Glaser 1970).

2.3. *A theoretical framework, from which can be derived the possible patterns or models of adapting instruction to individual differences in entry behavior.*

In figure 3 we have outlined the different instructional variables which can be manipulated to meet individual differences in different aspects of entry behavior.

The different resulting adaptations are by no means exclusive, they can combine in various ways.

Before we are able to outline different patterns of individualized instruction on the basis of these distinct types of adaptation, two other variables have to be considered, dealing with the *organization* of individualized instruction within a course.

By dealing with these two variables, we have to realize that group learning is the general case for school learning. By *group learning* we mean a school learning environment in which one teacher is working with a group of pupils on at least partly common objectives. Because the term group learning does not at all refer to one common instructional procedure, perhaps *classroom learning* is a better term.

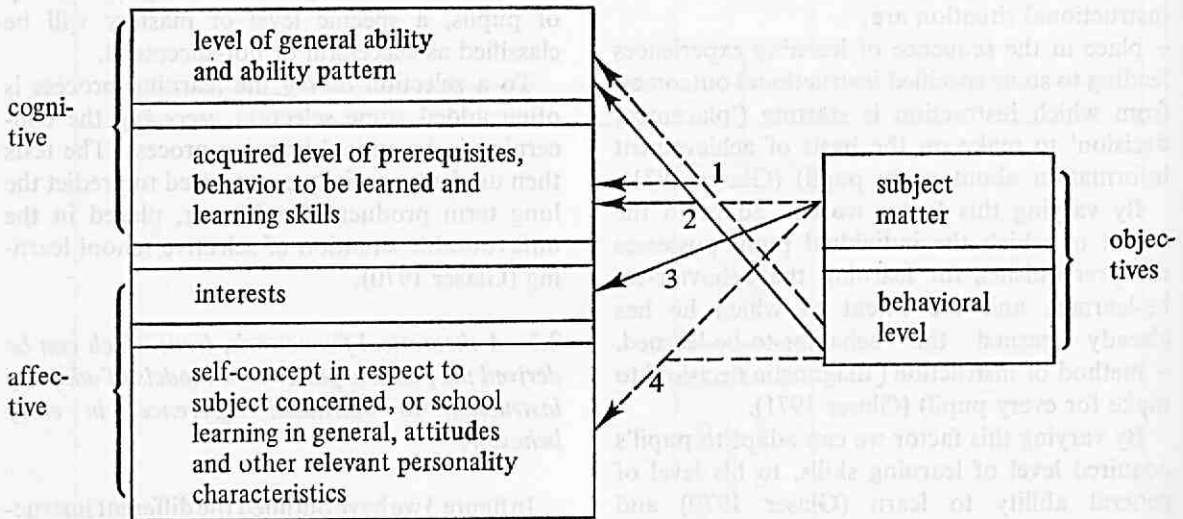
In the situation of classroom learning, individualized instruction, meaning instruction adapted to the entry behavior characteristics of the individual pupil, can be organized in different

Fig. 3 Type of entry behavior, to which instruction is adapted, and instructional variables used in adapting instruction.

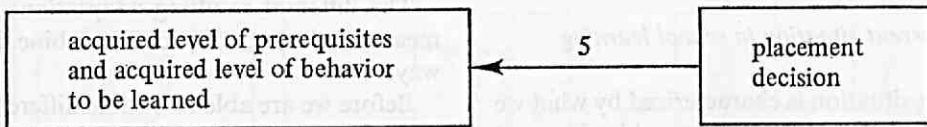
Aspects of entry behavior of the pupil

Variables manipulated in adapting instructions to individual differences in entry behavior

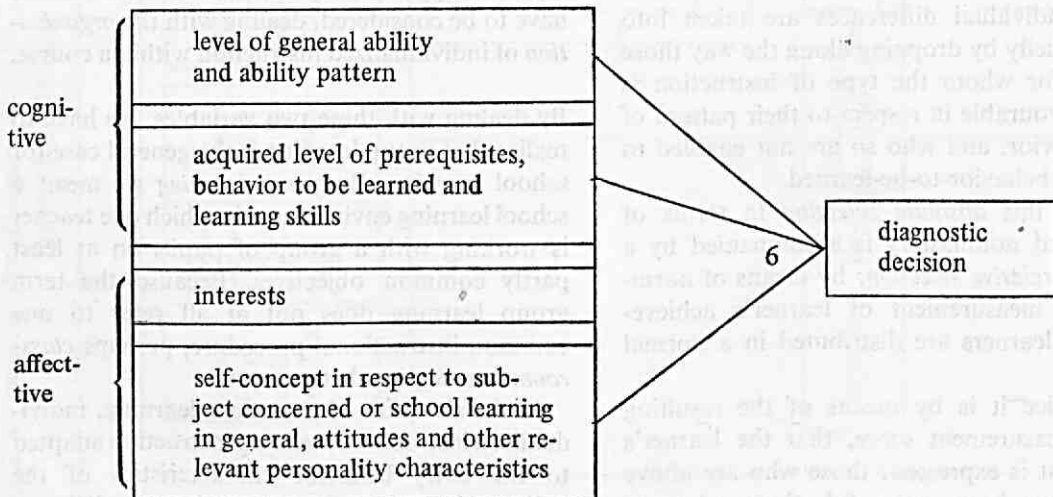
MODEL A. Adaptation by matching goals to the individual.



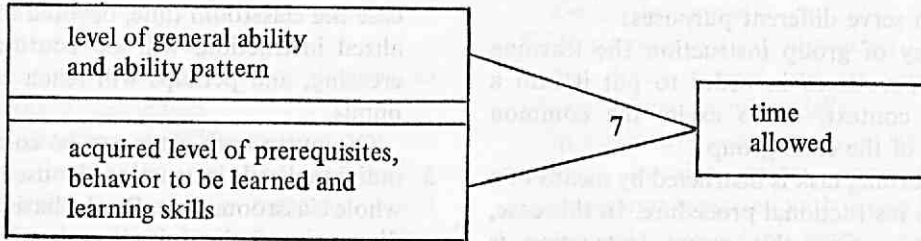
MODEL B. Adaptation by locating in different places in the sequence of learning experiences leading to some specified instructional outcomes.



MODEL C. Adaptation by altering instructional method.



MODEL D. Adaptation by flexibilization of time allowed.



Explanation to figure 3

1 = curriculum differentiation according to differences in general and specific ability and prerequisite achievement level. This type of adaptation is best known in the form of *schooltype differentiation*.

2 = *differentiation-in-depth* ('niveau-differentiatie') which means different degrees of penetration of a certain subject area or topic according to differences in general and specific ability and prerequisite achievement level.

To this type of differentiation belongs the *basic-additional level-model* ('basisstof-verrijksstof-model') as used in the instruction of mathematics in the so-called I.M.U.-project in Sweden and the so-called Schagen-project in the Netherlands.

3 = *differentiation-in-breadth* according to differences in interests.

To this type of differentiation belong the *basic-optional subjectmatter-model* ('basisstof-keuzestof-model') and the *track-differentiation* ('vak-differentiatie').

4 = curriculum differentiation with special programs for the slow learner, as for example Fenton's history courses for the slow and fast learner (E. Fenton 1970).

5 = differentiation in initial level of the content of instruction according to differences in acquired level of prerequisites and behavior-to-be-learned as reflected in differences in achievement test scores.

An example of this type of differentiation is the so-called *setting*.

6 = *didactical-methodical-differentiation*.

7 = *differentiation-in-rate* ('tempo-differentiatie'), which implies that pupils study the subject matter at different speeds according to ability.

An example of this type of differentiation is the so-called Roncalli-system in the Netherlands.

ways in respect to two variables:

One variable is the way of grouping the pupils, homogeneously or heterogeneously in respect to some criterion.

When as homogeneously as possible groups are formed, to which group instruction can be adapted as well as possible, we can speak of *inter-differentiation*.

In the case of heterogenous groups, instruction has to be adapted to individual differences *within* the class group. In this case we can speak of *intra-differentiation*.

The other variable is the part of total classroom time, which is devoted to individualized instruction.

In this respect there are different possibilities.

1. group instruction is used over the whole classroom time. In the case of heterogeneous class groups, adapting instruction then is only possible by selecting that instructional procedure, which fits all students in the sense, that they all are enabled to master the task to learn.

One could be inclined to think, that such an instructional procedure will be always one, which is constructed for the average or perhaps the slowest learner, and may be dull and too simple for the bright students. Cronbach (1967) however, on the basis of some empirical evidence (Osler Studies 1961) remarks, that it will not always be the instructional procedure using complex stimuli, at which brighter children are learning best.

2. instruction of a learning unit is started with group instruction and then succeeded by

individualized instruction. The group instruction can serve different purposes:

- by way of group instruction the learning task is *introduced* in order to put it into a general context, or to excite the common interest of the class group.
- the learning task is instructed by means of a *common* instructional procedure. In this case, after some time this group instruction is followed by formative evaluation. On the basis of the feedback, obtained by this formative evaluation, the succeeding individualized instruction is organized.

For part of the pupils, who already have mastered the behavior-to-be-learned, additional objectives are set up. For other learners, who have not mastered the behavior-to-be-learned, remedial teaching is set up.

This way of using classroom time is illustrated by figure 4.

In this case we have thus one main track from which students are branched off and after some time put back into it. One example of this organizational pattern offers Bloom's strategy of *mastery learning* (1968). Remedial teaching may be arranged only to solve the difficulties the individual learner has in mastering the *specific* task under consideration. But another possibility is that remedial teaching also includes teaching of better ways of dealing with the special class of tasks to which the task belongs, or school-tasks in general, in order to decrease the extra

time and help individual pupils need. In this case the classroom time, devoted to individualized instruction, will be continuously decreasing, and perhaps will reach zero for all pupils.

Of course both ways can be combined.

3. individualized instruction is used over the whole classroom time. On the basis of detailed diagnosis of the initial state of a learner, entering a particular instructional situation, educational alternatives are provided. In the course of the instructional process, by means of formative evaluation the individual pupil's learning progress is repeatedly assessed and on the basis of this the proper individual procedure is continuously reassigned (Glaser's model of individualized instruction (1967)).

3. Different patterns or models of individualized instruction.

3.1. Major variables which can be combined in different ways to form different patterns of individualized instruction.

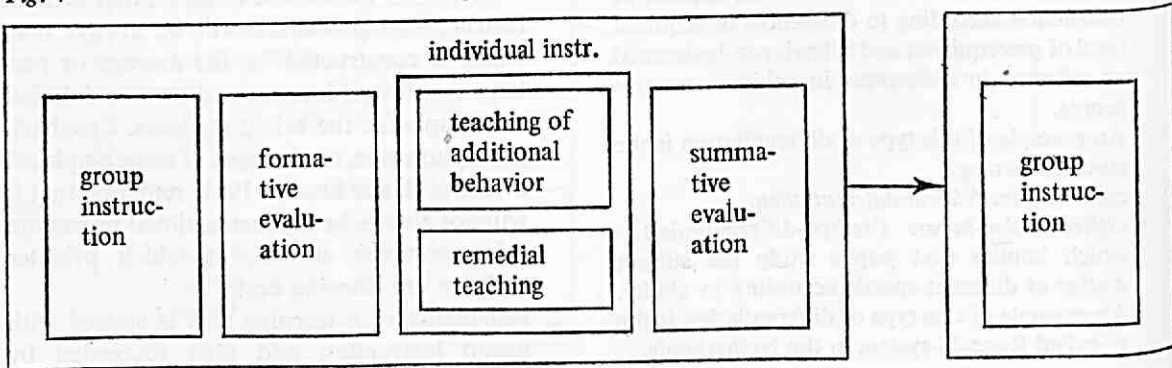
Resuming part 2.3. we have to consider 4 major variables which can be combined in different ways to form different patterns of individualized instruction:

1. type(s) of instructional variable(s) which is (are) manipulated in adapting instruction to individual differences in entry behavior (see figure 3).
2. aspect(s) of entry behavior to which instruc-

Fig. 4

Learning Task 1

Task 2



tion is (are) adapted (see figure 3).

3. way of grouping the pupils (homogeneous or heterogeneous class groups).
4. part of the total classroom time devoted to individualized instruction.

Of the numerous possible patterns of individualized instruction, in the succeeding section we only discuss those patterns, which have been developed in one or more countries. They all fit into the theoretical framework, outlined above.

3.2. Patterns of individualized instruction, developed in different countries

Adapting instruction by inter-differentiation. We have identified the following patterns:

1. schooltype differentiation.

After the elementary school pupils are distributed among different schooltypes, often by selectional procedures. The schooltypes differ in respect of curricula and instructional situation.

2. track differentiation ('vakkendifferentie')

Often on the basis of interests, pupils are distributed among different sets of subjects in the same school, with fixed objectives within a given course.

3. setting.

Within a given schooltype and each subject separately, pupils are divided into parallel classes on a certain grade level, homogeneous in respect of achievement level in the subject considered. So pupils are located in different places in the sequence of learning experiences leading to some specific instructional outcomes in the subject considered.

4. streaming.

Within a given schooltype, pupils are divided into parallel classes on a certain grade level according to some criterion of general ability. For each parallel class the instructional situation can be arranged adequately.

Adapting instruction by intra-differentiation. We have identified the following patterns:

1. the basic-extra subject matter-model ('basisstof-extrastof-model').

Of this model two varieties exist:

the *basic-optional subject matter-model* ('basisstof-keuzestof-model').

In an instructional situation arranged according to this model, instruction of a learning unit is started with group instruction about the *basic subject matter*, meaning the subject matter which has to be mastered by all pupils of the class group. After some time this group instruction is followed by formative evaluation. Those learners who already have mastered the basic subject matter, choose optional subject matter. The other pupils continue studying of the basic subject matter until most of them have mastered it. Some pupils of the latter group may soon reach mastery and have some time to study optional subject matter. Figure 5 illustrates the described model, which is especially well suited for subjects like geography, history and biology, in which interests of the student is the major factor for differentiation.

the *basic-additional level-model* ('basisstof-verrijkingstof-model').

The arrangement of the instructional situation according to this model is the same as described for the basic-optional subject matter-model above, with the exception that is differentiated between a basic behavioral level related to the subject matter concerned, which has to be mastered by the whole class-group, and a higher additional behavioral level, to which are admitted only the pupils who have mastered the basic behavioral level and which can be reached by studying enriching subject matter.

Figure 6 illustrates this model, which is especially suited for subjects like mathematics, physics and so on.

2. Bloom's strategy for mastery learning.

This strategy seems to be very much alike to the basic-additional level-model, described above. There is however, one major difference. While the basic-additional level-model seems to capitalize the existing individual differences

Fig. 5 Instruction according to the basic-optional subject matter-model.

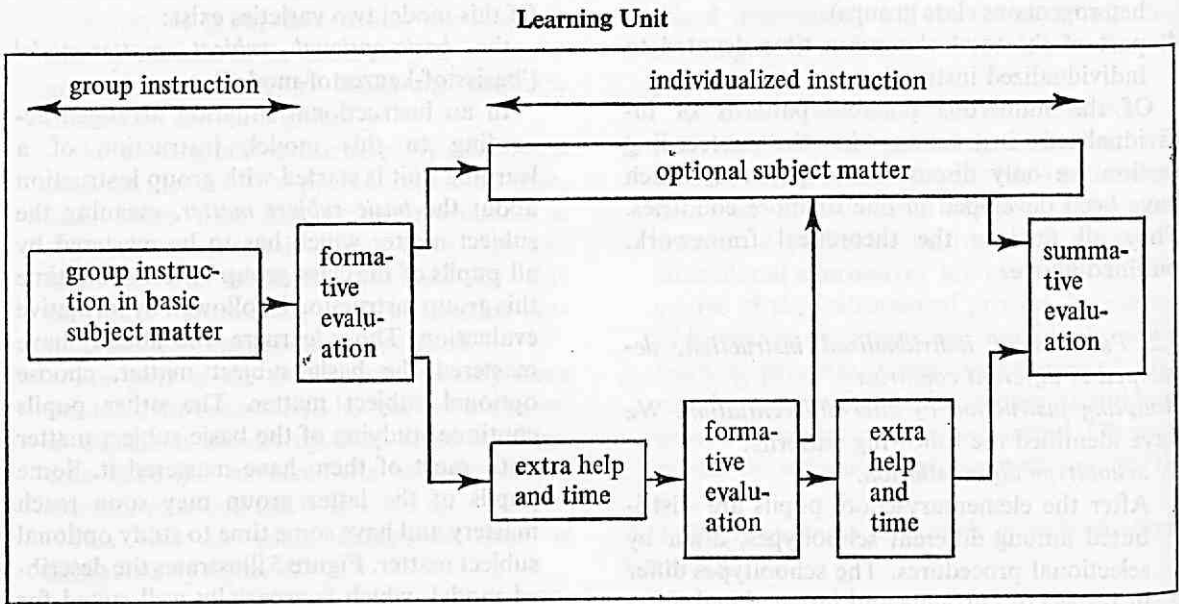
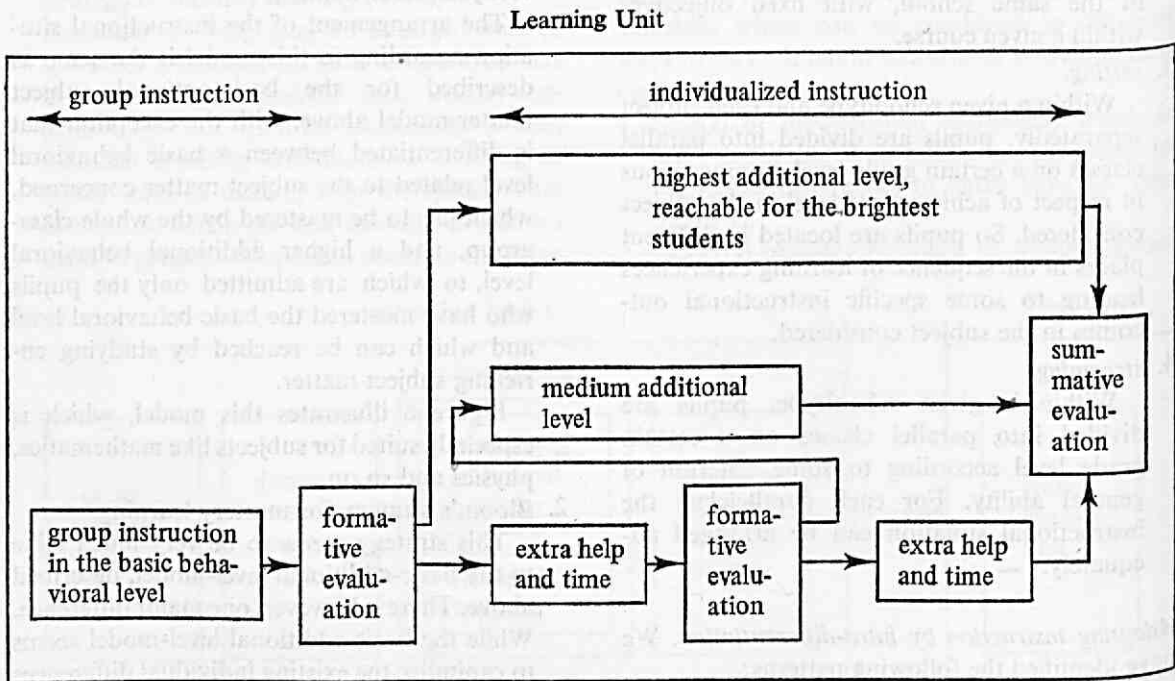


Fig. 6 Instruction according to the basic-additional level-model.



in entry behavior (ability), Bloom's strategy for mastery learning tries to reduce these individual differences during the learning of a sequence of learning units. Saying it in other words, this strategy tries to decrease the extra help and time several pupils need to master the basic behavioral level. So more and more pupils will be able to master the basic behavioral level by means of the initial group instruction, and less and less individualized instruction will be necessary.

3. *differentiation-in-rate* ('tempo-differentiate').

In this model, for example realized in the so-called Roncalli-system in the Netherlands, all the pupils have the same curriculum but every pupil can master this curriculum in his own speed. In the three foregoing models only 80 a 85% of all pupils are allowed to master the basic subject matter in their own speed.

The Roncalli-system, which will not be described further here, is especially interesting from the point of view of internal school organization. From the theoretical point of view it is not very revolutionary, and perhaps even based on a wrong assumption, namely that the rate of learning is exclusively determined by the ability of the learner.

Cronbach (1967) however has stated that the student's learning rate will also vary depending on the nature of instruction.

4. Glaser's model of individualized prescribed instruction (1967).

In this model, instruction is completely individualized so that no group instruction at all takes place.

On the basis of detailed diagnosis of the initial state of the learner at the beginning of some learning unit, and continuous assessment of pupil's performance during his learning of the unit, placement in the sequence of learning experiences and instructional treatment is completely adapted to pupil's level of ability and prerequisite achievement.

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