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ABSTRACT

The aims of this study are 1) to survey and summarize reports on predictions of teacher role changes, 2) to check the predictions against available empirical investigations, and 3) to discuss consequences of teacher role changes for teacher training, research on teaching, and the refinement of innovations. Some rationales for role prediction studies are considered. The reports researched indicate that relatively little interest has been shown in the teacher's role within an individualized system. The predictions and expectations identified are summarized to make possible an empirical check against six studies which use direct observations of teacher activities in the classroom as a source of data collection. There are reasonable grounds for predicting an extended use of individualized instruction aided by educational technology, and it therefore seems advisable to introduce student teachers into the fundamentals of this type of instruction. Other predictions are that the teacher will spend more of his time interacting with individual students and small groups and that team arrangements for common planning and execution of instruction will become more widespread. Empirical evaluation which is a basic feature of educational technology should include continuous checks on the teacher role so that modifications can be made in the system arrangements and appropriate teacher training programs can be designed. (MBM)

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TEACHER ROLE IN CHANGE

A survey of predicted changes in the teacher's role is presented, with special reference to expected changes associated with educational technology and individualized instruction. The expectations are related to findings of reported empirical observations of teacher activities in such innovative settings. The results and conclusions from this empirical check of the predictions are discussed in terms of their consequences for teacher training, research on teaching, and further development of educational innovations.

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1. Purpose

This paper will give attention to some currently discernible teacher role changes which can be expected to become still more accentuated in the future. Particularly such changes will be brought into focus that are related to individualized instruction based on educational technology principles. A study of these changes is of relevance also to other areas of school innovation not directly alluded to, e g team teaching and non-gradedness, since the latter organizational arrangements are often prerequisites for or consequences of more basic instructional developments.

The aims of the present study are threefold:

1. to survey and summarize reports on prediction of teacher role changes;
2. to check the predictions against available empirical investigations;
3. to discuss consequences of teacher role changes for teacher training, research on teaching, and for the refinement of innovations.

Before entering upon these topics some rationales for role prediction studies will be considered.

2. Need for prognosis of teacher role changes

Attempts to identify new teacher functions accompanying educational innovations are worthwhile by several reasons. A few of these will be mentioned here.

In order to be adequate for its purposes teacher training should be sensitive to current trends and probable future changes in the educational field. The student teacher of today will become the teacher of tomorrow and for many years to come. A teacher training program that does not take into account reasonable predictions of new teacher functions misses an essential point. Of course, extrapolations into the future must be made with a critical mind and be based on objective evidence. Many pedagogical innovations are fads and not all of them deserve to be integrated with or have effects upon teacher training programs. To decide what innovations have come to remain requires delicate judgments, but such decisions must nevertheless be made continously if teacher training is to play a progressive rather than a conservative role in education.

Attention to emergent new teacher functions is also a fundamental interest for research on teaching. An important task for this branch

of educational science is the search for teacher behaviors and other teacher characteristics that are causally associated with student learning. The scientific principle of parsimony implies that in the choice of research variables those variables should be given priority which are potentially most fruitful. What will be judged as most promising teaching variables is, however, dependent upon the total instructional setting and especially upon the teacher's role within it. Up till now most teaching research has been carried on in a frame of traditional teacher functions. It is worth noticing that two related main streams of educational research during the sixties, instructional process analysis by systematic observation and instructional systems development, have run parallel rather than convergent to each other. The common interest of making clear the unique role of the teacher is a natural rendez-vous of these active lines of research. A fusion of "describing" and "improving" research would no doubt lead to a better understanding of what teaching variables and teaching problems should receive research priority.

For the further refinement of innovations an analysis of the teacher's role is a necessary condition. When a new instructional method or system is introduced it is sometimes implicitly taken for granted that the teacher role is more or less automatically defined by the system. In actual fact, conflicts are probable between well established teaching patterns and radically new teacher functions. Due allowance must be made to such discrepancies if the innovation is to work efficiently. In order to be realistic, predictions of the teacher role within an instructional system cannot rely merely on theoretical role expectations but should be supplemented by empirical observations of the teacher's actual behavior.

It might be considered somewhat premature to regard educational technology and individualized instruction as pedagogical contributions of established value. These innovations have not yet had a definite break through in the educational world, nor have they so far conclusively proved their superiority to conventional instruction, although positive results have often been reported.

In spite of such uncertainties there is still reason to believe that individually adapted instruction based on educational technology (not synonymous with "hardware" but defined in the broad sense of systematically developed and evaluated instruction) has come in order to stay.

Individualization, meaning instruction adjusted to the individual student's needs, abilities and interests, is a generally accepted educational principle. Its slow realization is probably due mainly to lack of adequate material and aids to supplement the teacher. The supply of self-instructional material is still insufficient but is growing rapidly. It can e g be mentioned that one of the more comprehensive systems for individualized instruction, the PLAN project, covers such a broad area as language arts, social studies, mathematics and science for grades 1-12. The increasing number of similar systems as well as individualizing aids of more limited scope is an indicator of the development force in this area. It seems a reasonable prognosis that these trends will have a growing impact on educational practices and the teacher's roie.

3. Predictions of a new teacher role

In comparison with the attention devoted to other aspects of educational technology rather little interest has been given to the teacher's role within an individualized system. The pioneers of programmed instruction touched upon the subject with a light hand as is reflected by the following quotations from S L Pressey and B F Skinner:

> ... teachers are now heavily burdened with routine and clerical tasks that might well be handled mechanically - thus freeing the teacher for much more real teaching, of the thought-stimulating and ideal-developing type, than is now possible. (Pressey, 1)

> Of course, the teacher has a more important function than to say "right" or "wrong". The changes proposed would free her for the effective exercise of than function. Marking a set of papers in arithmetic - "yes, 9 and 6 are 15; no, 9 and 7 are not 18" - is beneath the dignity of any intelligent individual. There is more important work to be done - in which the teacher's relations to the pupil cannot be duplicated by a mechanical device. Instrumental help would merely improve these relations ... If the advances which have recently been made in our control of behavior can give the child a genuine competence in reading, writing, spelling, and arithmetic, then the teacher may begin to function, not in lieu of a cheap machine, but through intellectual, cultural, and emotional contacts of that distinctive sort which testify to her status as a human being. (Skinner, 2)

Other authors have frequently paraphrased these views without adding much specificity. The last few years have, however, seen an awakening interest in teacher role problems connected with the kind of innovations discussed here. Symptomatic of this development is that a recent issue of the journal Educational Technology (1970:2) was devoted mainly to the changing role of the teacher.

With the purpose to gain a representative picture of predicted new teacher roles the author has searched a number of relevant handbooks, journals and institute reports from the last ten-year period. A sample of the excerpts gathered will be presented here and followed by a summary of main expectations about teacher role changes. Subjectively chosen as the sample is, the intent has been to represent current views as adequately as possible.

A concrete way of depicting the teacher functions in an individualized system is to describe a typical day as seen from the teacher's point of view. Such a picture has been given by Kooi & Geddes (3) in a description referring to a computer assisted system.

> The typical day in a school with a fully developed management system would begin when the teacher picks up computer-produced reports summarizing student performance data collected the day before, and suggesting procedures and schedules for the current day's lessons. It would take some time to study these reports, noting first the students who progress normally from one unit to the next, and posting work assignments for those who should continue in self-directed units or modules. The computer report would probably list several students who are ready for a film, a group presentation, or a progress test. The teacher would schedule these - using, in a more advanced management system - an on-line program. The daily report might also flag students who face special problems, like sudden changes in score patterns, unreasonable time in particular units, too many student choices in one content area, or special program planning problems.
>
> The teacher would use the computer to call up resources for remedial lessons, plan a counseling session of her own, or assist the student to an appointment with the counseling staff. She would then check her own assignments for teachers' planning conferences, or classroom presentations and discussion groups to be lead. Some preparation time would be scheduled during the day for this approaching work. Here again the computer would be a help, allowing the teacher to query the system for available resources for her presentations. The teaching day would follow the morning planning period, with students moving in and out of units and lessons that were assigned. At the end of the day the teacher would spend another short period organizing tests and observations or ratings for submission to the management system, so that her computer aids to planning would be ready for the next day.

As a comparison will be given a description by Jivén (4) of typical activities in preparing and carrying out a lesson in a Swedish instructional system in mathematics. Here ordinarily a team, consisting of two teachers and an assistent, is in charge of a "Big Class" which is composed of three regular classes. To the assistent are delegated many of the tasks performed by the computer in the above system. In condensed form the functions of the teachers and the assistent are described as follows:

The lesson is prepared during a conference held by the teaching team to determine what tests should be given, what group instruction should take place, who should be responsible for the group instruction, what material should be distributed to different students. The group instruction, if any, is prepared by the teacher nominated.

During the lesson the teachers circulate among the students, helping those who have got struck, supervising the students, spurring and encouraging them, discussing the results of diagnostic tests, helping them to chose appropriate sections for repetition. One of the teachers may be busy with group instruction. Meanwhile, the assistant is working with distribution and collection of material, supervision of students taking diagnostic tests or solving problems, recording the students' progress through the course, noting the extent of homework, checking attendance. The assistant is expected to be sufficiently familiar with the course material to be able to answer simple questions asked by the students. Most often, however, the assistent will refer the student to one of the teachers. After the lesson the assistent takes care of the material and as a preparation for the next conference gathers data on student progress. To the assistent's intersession duties also belongs to be responsible for the material, to make available required material, to record the students' current status, progress, homework, and diagnostic test results. Other tasks are to mark diagnostic tests, aid the teachers with material for group instruction, take notes during conferences and record parent contacts.

At the next conference (one conference per week and Big Class is a minimum) team members discuss their experiences, survey diagnostic test results, plan measures to be taken (e g individual or group tutoring), make special arrangements for individual students.

Other authors have expressed their predictions of teacher roles by listing new features of the teacher's task. Thus, Hansen & Harvey (5) present the list below with reference to computer assisted instruction:

1. The teachers will perform much less of the informational presentation functions presently found in our classrooms. The teacher will become more involved in the managerial and strategy functions, such as sequencing and evaluating the instructional process.
2. Teachers will play less of the corrective role in terms of their questioning and evaluative behaviors.
3. Teachers will become more concerned with individual characteristics important in designing an instructional strategy.
4. Teachers will have a greater involvement in guiding individual students rather than in maintaining classroom discipline. With the computer relieving the teacher of the informational presentation tasks, she will be able to devote the time usually expended in group communication to individual counseling and advising.
5. Teachers will have to perform a wider range of discussion techniques, involving a richer opportunity to affect the social and emotional behavior of students. Teachers will have to have greater skill and understanding of human behavior, viewed in the broadest terms. This requirement may in part be aided by the CAI system's informational retrieval capability, which may monitor the patterns and rates of student development.
6. Teachers will have a greater array of differentiated professionals joining them in the team effort to provide optimal instruction. Some

teachers may become more competent in the application of technological procedures and functions for the fullest employment of computer technology.

7. Teachers may take on more of the diagnostic assessment and prescriptive functions presently assigned to the school psychologist. Teachers may utilize more group interactive procedures in an attempt to develop latent social and creative talents within their students.

Another systematic analysis of teacher roles in connection with individually prescribed instruction has been reported by Lindvall & Bolvin (6). They make a distinction between teacher tasks in operating the system, in supplementing it, and in pursuiting goals not covered by the system. The system operation functions listed are:

1. The evaluation and diagnosis of the needs and the progress of each student.
2. The development of individual study plans of prescriptions.
3. The development of immediate and long-range plans for the total class, which take individual needs and plans into account.
4. The planning and organization of the classroom and the class period to create an effective learning environment.
5. The development, in cooperation with other members of the professional staff, of plans for any necessary large group instruction.
6. The supervision of the work of para-professionals such as technicians and teacher aides.
7. The study and evaluation of the system so as to improve its operation in this classroom.

As a supplementary teacher function is mentioned the need for adding observations from day-by-day interactions between teacher and learner to the information gained from formal tests and records so as to reach an optimal diagnosis. Taking exceptions from the system when necessary also belongs to this role category. The teacher may e g find it appropriate to lower the requirement on a skill or a unit for one student, to have another student skip certain units, or to provide individual or peer tutoring for others.

Among teacher functions outside the scope and goals of the instructional system, the counseling role is particularly emphasized. Listening to and discussing the student's concerns and problems, helping the student in personal interviews to adjust his study program to his needs and to set up realistic goals, are parts of this role. Another is to create a favorable learning atmosphere by being an agent for selective reinforcement of desirable student actions. The authors stress the possibilities of using behavior modification principles for such purposes.

Lindvall & Bolvin's paper is one of the few attempts to analyze, not only teacher tasks necessary for monitoring the instructional system per se, but also his extra-system functions. The latter prediction problem is no doubt the more difficult one, since the goal and content area optimally covered by preproduced instructional materials and systems has not yet been established with any degree of certainty. In spite of the difficulties it seems highly desirable to come to grips with the problem of what will constitute unique teacher functions in addition to managing intrasystem tasks. In an article on teaching machines, Hilgard (7) has made some reflections on this issue. He regards the new technical devices as a possibility to free the teacher from routine instruction, from imparting information and questioning about facts and computations. The time gained should be used for such essential tasks as stimulating, encouraging and inspiring the students. In developing his view Hilgard distinguishes between expository and hypothetical modes of teaching. For expository teaching, that is communicating firm knowledge to the students, technological aids can be expected to serve very well. But in the hypothetical mode of teaching-learning, meaning discovery, exploring possibilities and judging between alternatives, a human teacher is irreplaceable. Also when considering the convergent - divergent thinking dichotomy, Hilgard finds essential unique contributions for a live teacher. To make the student alert to problems, help him discover what facts are needed for solving a problem and how to search them, are such teacher functions. Still more clear is the need for the flexible and stimulating teacher assistance in divergent, creative and original activities. Since much intellectual work takes place in social situations there is also great value in familiarizing the student with communicating and sharing ideas with others when solving problems, seeking and discussing their suggestions and criticism. Hilgard further emphasizes the extent to which social life means diversity, need for compromises between fractions and necessity to see individual actions in the light of their consequences for others. For goals of this quality the contributions of a human teacher rather than of technological devices are regarded a sine qua non.

Discussing the same problem, Gage (8) notes that at a first glance computer-assisted instruction seems to give promise of handling individualization and instruction directed to well defined cognitive objectives better than a teacher. But confronting the apparent potentialities of CAI with empirical evidence he finds certain limitations which make a far-

reaching substitution of human teacher functions doubtful. Individualization is more than adjusting the rate and content of instruction to the needs and abilities of the individual student. Gage refers to observations in natural classroom situations which have highlighted the importance of such uniquely human aspects of individualization as being humorous or serious at the right time, affording examples that are relevant to the individual student, and responding to him as one human being to another rather than as an object for behavior modification. Referring also to experiences with CAI which have indicated that tutoring and dialog, as distinguished from the simpler drill-practice level of instruction, are still beyond reach for the technologically based systems, Gage concludes that for a reasonable time in the future there will be need for human teachers, flexibly responsive to individual students and technically skilled in assisting them toward attaining higher-level cognitive goals as well as social and affective learning objectives.

Since a main purpose of this paper is to compare predictions of future teacher functions with the results of empirical studies, the above reviewed predictions and expectations will be summarized so as to make possible an empirical check against the data surveyed in the next section. The following seem to be the main expectations of a teacher working within an individualized system based on educational technology principles as distinguished conventional teaching:

The teacher is more involved in

- individual contacts with the students
- diagnostic and evaluative activities
- prescriptions on learning activities and materials
- planning and organization
- preparation of instruction
- cooperation with other personnel
- counseling and guidance
- supervision of students working independently
- small group tutoring
- stimulating, motivating students, giving positive feedback
- higher-order cognitive, heuristic teaching

The teacher is less involved in

- contacts with the whole class
- presenting fact information, drill-practice activities
- routine managerial tasks
- giving negative feedback
- talking (total amount)
- talking (in relation to student talking).

4. Empirical studies of teacher activities in individualized instruction

Empirical checks on predictions of teacher functions in highly individualizedinstructional systems have up till now been scare, but a few such studies have been reported in the very last years. In this section available studies of relevance for the present problem will be reviewed and their results confronted with the hypotheses summarized above. Most of the studies have used direct observations as a source of data collection; som have supplemented the observations with questionnaires or rely entirely on such information. With a single exception the studies are limited to teacher activities in the classroom. It should also be remarked that the reports vary in specificity and detail.

Hill & Furst (9). This study referred to computer-aided instruction in high school biology and developmental reading. Four biology and two reading teachers who taught both CAI classes and control classes of approximately equal ability level were observed by a modified version of Flanders' Interaction Analysis System. In addition the teachers completed a questionnaire designed to elicit their perception of differences in the two instructional modes.

Here are some of the main results of the comparisons:

1. Interchanges with individual students were more frequent among CAI teachers. Control teachers adressed themselves primarily to the whole class or to individuals within the whole class.
2. Informing teacher talk occurred in equal amount among CAI and Control teachers. However, CAI teachers talked more about classroom procedures, whereas Control teachers informed mainly about subject matter content.

3. The observations indicated less corrective feedback in the CAI classes. The difference could be ascribed to a higher frequency of negative verbal behavior directed to subject matter concerns among the Control teachers. No difference was found in the amount of teacher criticism directed at misbehavior. Questionnaire data were somewhat ambigous in these respects. The CAI teachers perceived the class as having fewer discipline problems, but at the same time they were aware of more distractions in the CAI situation.

4. More time was spent in silence in CAI classes. No clear pattern of how the teachers spent their time during these silent periods emerged.

5. Indirect light was thrown on the teacher role by the observation that students initiated more questions in CAI classrooms. The questions were primarily directed at process rather than subject oriented.

6. Questionnaire and observation data indicated that CAI students could be left to work on their own to a greater extent.

7. CAI teachers reported less homework, less paper grading, less lecturing and less need for control of subject matter. The differences were, however, moderate.

8. Both CAI and Control teachers exhibited very little student supportive behavior, with a mean of 2% or less of all behaviors.

Neujahr (10). By means of a modified Bellak-system 11 individualized lessons in mathematics, social studies, and science of a grade 6 class were analyzed from videotapes. The results were compared with data reported earlier by Bellak and with observations from two lecture-discussion lessons in the same class that had the individualized lessons.

It was found that

- 59% of the teacher's "pedagogical moves" during I-lessons were directed to individual students against 1% during lecture-discussion lessons;
- the proportion of teacher talk/student talk was 2.2 during I-lessons. Corresponding proportions in lecture-discussion and in Bellak's material were 3.5 and 2.7, respectively:
- teachers and students used the same types of pedagogical moves to a higher degree in I-lessons than in class-instruction. E.g., of the structuring moves performed in I-lessons 50% came from the teacher

and 50% from the students, while in Bellak's study the relation was 86% - 14%.

- there were clear differences as to the content of communication. In I-classes 84% of all moves contained instructional (procedural) meaning compared with 57% and 37% in lecture-discussion and Bellak-material. For substantive (subject-matter) meaning reversed proportions were recorded.

Flynn & Chadwick (11). Teachers in grades 1-12 were observed when working with an individualized method - material system called LAP (Learning Activity Packages) and compared with teachers in other classes. Data were gathered for altogether 109 teachers, 36 of which were studied intensively. A special observation schedule was constructed and used together with Flanders' Verbal Interaction Scale and Honigman's Multidimensional Analysis of Classroom Interaction.

The comparisons indicated that LAP teachers devoted more time than control teachers to

- getting supplies and materials for students;
- traffic control (e. g. taking roll, directing students' whereabouts);
- using various non-instructional materials to aid in the management of students;
- housekeeping chores such as cleaning equipment;
- making evaluative comments about students;
- giving grades to students and discussing grades;
- giving directions to students regarding aspects of the educational environment;
- directing students to do logistical tasks (e. g. get supplies);
- events coded as "no observable relevant activity":

The LAP teachers spent less time than the control teachers in

- presenting subject matter information to the students;
- the management of cognitive activities through the use of non-cognitive directions, requests, etc.
- asking questions and selecting students to answer questions;
- interacting with the whole class.

An apparently surprising result was that LAP and control teachers spent about the same time in contacts with individual students. However, in the control classes these contacts most often occurred in front of the class, while in LAP classes the teacher interacted with individual students without involving the other students. Some observations of student behavior gave indirect information about the teacher role. In LAP classes 52% of the contacts were initiated by the students against 34% in the control classes, a result similar to that found by Neujahr.

Jivén (12). In connection with the field testing of the individualized mathematics system (IMU) mentioned on p. 5 a questionnaire was given to 190 teachers in grades 7 and 8. The comparisons made are between IMU teachers working as a team responsible for a Big Class and IMU teachers each in charge of a single class. No comparisons with teachers in conventional classes are included in the report, but the study is of special interest as it throws light on teacher tasks and activities not only within but also outside class.

The average proportions of time the teachers spent on different activities in class (during lesson time) were:

	Team teachers	Single teachers
Individual tutoring	70	57
Group instruction	15	9
Supervision of students	14	11
Material management	5	11
Keeping student records	3	13

The table clearly shows that the team arrangement means a different instructional situation for the teacher, with more individual tutoring time and less time for managerial and clerical tasks.

For tasks outside class (non-lesson time) the team teachers used less time than the single teachers; the averages per week were 152 and 198 minutes, respectively. The relative distribution of this time was as follows:

	Team teachers	Single teachers
Conferences	27	12
Planning group instruction	9	5
Grading papers	15	28
Keeping student records	1	12
Material management	3	9
Studying the students' text material	31	22
Studying teacher's manuals	13	11

The resource of an assistent within the team apparently brought on a reduction of clerical and managerial tasks for the team teachers also when working outside class. Instead they spent more time in conferences and in studying subject matter.

Even without available comparison data from ordinary instruction it seems evident that The IMU teachers have a different role situation from the usual one. In class individual instruction dominates, with rather little group instruction; outside class considerable time is used especially for conferences with team colleagues.

Quirk, Steen & Lipe (13) and Steen & Lipe (14). In order to test the effects of a special training course for teachers involved in individualized PLAN instruction, 58 PLAN teachers and 28 Control teachers from grades 1-12 were observed by means of a schedule containing 17 categories. The categories were chosen so as to give information on a number of expectations about teacher behavior. It was hypothesized that the PLAN teachers would spend more time in diagnostic and didactic inquiry, decision facilitating, giving positive messages within behavior modification, and in total individual instruction; and less time in providing content in group discussion, giving negative messages, managing learning material, and in managing student activities.

In accordance with predictions PLAN teachers devoted more time to diagnostic and didactic inquiry (21% compared with 7% for Control teachers). Also for individual instruction results were in the expected direction (34% - 10%). Positive feedback was given more frequently by PLAN teachers when all grade levels were considered, but with a reversed tendency at the secondary level. In the case of negative messages to the students the differences were in the predicted direction except at the primary level. No significant differences were found as to decision

facilitating and in providing content within group discussion. Contrary to expectations the PLAN teachers used more time in managing learning materials and student activities.

On the basis of the experiences gained in the above study, the second year's teacher training program was modified, especially in those parts where the hypotheses had not been supported. Comparisons have so far been reported between teachers who took the original training program and teachers who went through the modified version. It was found in a new observation study that the new teachers spent less time in managing student activities and learning material. They also made less use of negative feedback to the students, but the anticipated increase in the use of positive feedback among the teachers who had been trained with the modified program was not substantiated by the empirical data.

5. A check of predictions against empirical findings

The expectations about teacher role will now be compared with the results of the studies surveyed in the preceding section. As a frame for the comparisons will be used the summary list of predictions presented on pp. 9-10. The signs in the "Empirical support" column are defined thus:

+	clear empirical support for the expectation
(+)	probable empirical support for the expectation
=	expectation unsupported, no difference reported
-	expectation unsupported difference in "wrong" direction
0	no empirical evidence available

The figures in the "Source" column refer to the number of the study, as given in parenthesis after the author's name, e. g. Hill & Furst (9).

Expectation	Empirical support	Source
More		
individual contacts with the students	+	9, 10, 11, 12, 13
diagnostic and evaluative activities	+	13
prescriptions on learning activities and materials	+	9, 10, 11, 13
planning and organization	(+)	11, 12
preparation of instruction	(+)	12
cooperation with other personnel	(+)	12
counseling and guidance	0	
supervision of students working independently	+	9, 13
small group tutoring	0	
stimulating and motivating students, giving positive feedback	= (+)	9 13
higher-order cognitive, heuristic teaching	0	
Less		
contacts with the whole class	+	11, 12, 13
presenting fact information, drill-practice	(+)	9, 10, 11
routine managerial tasks	- (+)	9, 10, 11, 13 12
giving negative feedback	+	9, 13, 14
talking (total amount)	0	
talking (in relation to student talking)	+	9, 10

As can be seen, a number of the expectations about teacher role in an individualized system are sustained by empirical observations. Thus, in comparison with ordinary instruction the teacher interacts more with individual students and less with the whole class, is more involved in prescribing learning activities or supervising independent work and less in presenting information. There are also indications of more frequent student contact initiatives, higher proportion of student talk and higher ratio of positive/negative feedback given to the students.

In some other respects the empirical support for the expectations is uncertain. It has not been convincingly shown in the studies that planning, organization and preparation of instruction are distinctive features of the teacher's tasks in individualized systems, nor has the diagnostic function been evidenced with doubtless clarity (although it did so in the only study

that included this aspect). More extensive cooperation with other personnel is indirectly suggested in one study; the others give no information on this point.

One of the most often expressed hopes about new technological devices and systems is that they would free the teacher from routine tasks. This expectation is not fully substantiated by the present data. Most of the studies have rather shown more routine managerial tasks for the systems teachers. The results from one study (12) suggest, however, that it need not be so if proper team arrangements are organized.

For some of the most important prediction aspects empirical data are lacking. It is still to be learnt whether small group tutoring and counseling - guidance are more emphasized in the individualized setting. The last mentioned function was touched upon in (13), where decision facilitating was found to be somewhat but not significantly more frequent in the individualized situation. Neither do the empirical studies give evidence on the question to what extent the teachers are engaged in "thought-stimulating" as contrasted to fact informing and controlling activities. Although the teachers in the individualized systems have rather consistently been found to spend less time in imparting subject matter to the students, no analysis has been reported to determine the kind and quality of content related discourse.

6. Conclusions

A few concluding remarks will be made to the preceding survey, with special reference to the issues discussed in the beginning of this paper: teacher training, research on teaching, and further development of the innovations.

There are reasonable grounds for predicting an extended use of individualized instruction aided by educational technology. It seems therefore warranted to introduce student teachers into the fundamentals of this kind of instruction. Since the teacher training program has limited time at disposal such an introduction can hardly be more than aquaintance with basic principles and some first-hand experience in the field. Intensive training in special procedures has its proper place in later in-service courses.

Even if training in the details of particular systems must by necessity be of limited scope, many of the features of individualized systems have

such a general applicability that they should be given greater attention than is usual in most present teacher training programs. Emphasis on continous diagnosis and evaluation of individual students, providing the student with material for independent study, counseling and guiding him in his short- and long-range plans, are examples of teacher functions that will become increasingly valid in the future, irrespective of whether advanced technology is utilized or not.

Another reasonable prediction relatively independent of how far extreme individualization will go is that the teacher will spend more of his time interacting with individual students and small groups. Consequently, a larger proportion of teacher training should be devoted to techniques appropriate in such situations. Likewise, team arrangement in some form or other for common planning and execution of instruction will probably become more widespread, and the student teacher should be given experience of such cooperation and task differentiation during his training. Considering the need for individualization of instruction, one should not forget the necessity of individualizing teacher training as well. Diagnosis and appropriate prescriptions are equally important here as in education generally.

Also for research on teaching some learnings can be made from the educational technology development. Teaching research has so far been concerned mainly with instruction in a conventional educational setting: lecturing, discussion, demonstration, or laboratory work in large groups. A relatively greater attention to "micro-situations" in the sense of instruction with one or a few students is justified not only by the scientific reason of simplifying the object of study, but also because this will probably become a usual and important situation in the classroom.

Another conclusion to be drawn for research on teaching is that the potentially most fruitful variables should be sought among teacher behaviors that represent unique teacher functions. They are apparently less likely to be found in fact presentation or student drill on a question -and -answer level than in the teacher's flexible attempts to raise the student's thinking to a higher cognitive level and to encourage and reinforce his creative efforts. Teacher variables of this kind should be given priority in the study of efficient teaching. Also to be taken into consideration as research variables are several teacher functions which are usually performed outside class: planning, organization and preparation of instruction. As teaching success can be predicted to become

more a function of the teacher's ability to act as an efficient "facilitator" of student learning rather than an imparter of information, greater research attention should be directed to such management aspects.

The most direct implications of the present survey bear upon the further development of instructional systems. The empirical studies have shown that teacher behaviors and activities on some accounts have been accordant with expectations, but that in other respects it is doubtful whether aspired role functions in the new setting are attained. From available empirical evidence it seems as if the teacher is not less engaged in routine tasks than in conventional instruction. It is also uncertain whether most present systems for individualizing instruction afford better opportunities for teacher - student interactions of the kinds that will promote complex problem solving skills, creative thinking, realistic goal setting, and social-emotional development, to mention a few educational objectives that are expected to be more efficiently reached in individualized instructional systems.

The above observations and considerations strongly suggest that in the development and revision of individualized instruction systems the teacher functions should be given as much attention as other aspects of the system. Empirical evaluation which is a basic feature of educational technology should include continous checks also on the teacher role. On the basis of information gained by such empirical controls successive modifications in system arrangements can be made and appropriate teacher training programs designed. Experience in some of the projects reviewed earlier seems to indicate that it is possible to overcome limitations of the kind discussed here.

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