

# Evaluation of Programmed Education Among Juvenile Diabetics and Their Families

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## SUMMARY

Patient education and involvement is a vital part of quality medical care in chronic diseases, such as diabetes mellitus. In this study the acceptance and effectiveness of programmed machine instruction was evaluated. Young diabetics and their parents can be taught about the disease and its control using an automated technic. There was no objective evidence to indicate control of the disease was significantly improved over a brief period of three months. Patients and parents participating in this study expressed acceptance of programmed instruction as a valuable adjunct to the total education process but stated that this technic should not be the sole educational method employed. *DIABETES* 21:967-71, September, 1972.

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It is estimated that there are over 4.5 million individuals with diabetes mellitus in the United States. Currently there is no known cure for this disease; but it can be controlled, thus permitting the diabetic to lead an active and productive life. Proper control, however, is more likely to occur when an informed patient cooperates with an interested and knowledgeable medical team.

Recent studies conducted among juvenile diabetics revealed that the majority of the children studied were poorly informed about their disease.<sup>1</sup> Follow-up investigations among parents of these children also indicated marked lack of understanding of basic fundamentals of diabetes.<sup>2</sup> Beaser,<sup>3</sup> Stone,<sup>4</sup> and McDonald<sup>5</sup> reported a similar lack of knowledge and understanding among adult diabetic patients.

Education of patients with diabetes mellitus is thought to be performed best by a professional team working within a planned education program. Evaluation studies of knowledge of diabetes among physicians, nurses, and dietitians, however, have revealed a frequent serious lack of understanding of basic concepts of the disease even

among these groups.<sup>6</sup> Consumer education programs require a significant amount of professional time which is expensive and in limited supply; consequently, new teaching methods must be assessed. Studies have previously been reported on the use of the teaching machine in teaching adult patients about diabetes mellitus.<sup>7</sup> The objectives of this study were to determine the effectiveness of programmed instruction among juvenile diabetics and their parents by assessing: (1) if factual knowledge of the disease and its control could be increased; (2) if objective evidence of improved short-term control could be demonstrated; and (3) if this form of instruction is acceptable to the participants.

## METHODS

The teaching machine used was the AutoTutor Mark II designed by U. S. Industries, Inc., New York City. The machine (figure 1) is a semi-random access film projector with a rear projection screen. To the right of the screen is a row of ten selector buttons. A branching system of instruction is utilized permitting students to progress at their own rate by selecting the proper response to questions posed at the bottom of each projected frame. If the wrong answer is chosen, however, the next frame explains why the answer was wrong; and the student returns to the preceding material and answers the question correctly before continuing. The programmed material was developed under the direction of the U. S. Public Health Service. Dr. Arthur Krosnick, Diabetes Coordinator, New Jersey State Department of Health, prepared the information; the film, "Taking Care of Diabetes," was programmed by Miriam Hoggund Sierra-Franco. Included in the material is general information on diabetes, its occurrence, symptoms, diagnosis, treatment, diet, food exchange lists, special dietary considerations, medication (use of oral drugs and insulin), exercise, hygiene, urine testing, and complications.

One hundred and five juvenile diabetics and 163 adult members of their families participated in this study. There were fifty-six girls and forty-nine boys, rang-

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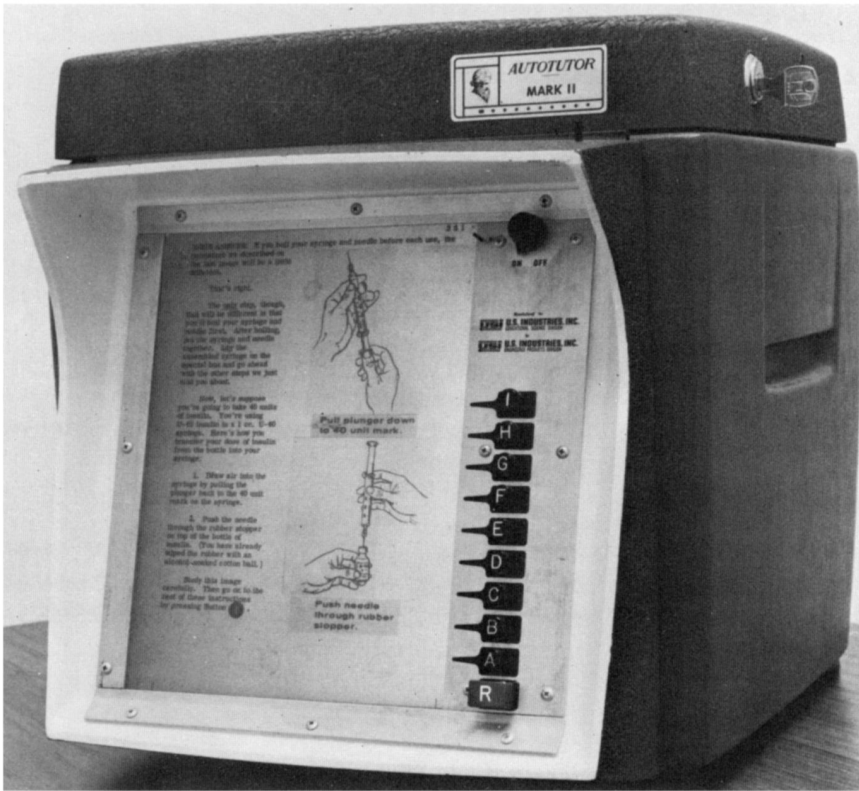


FIGURE I  
Mark II AutoTutor used in study.

ing in age from one through eighteen years (table 1). Children nine years of age and older were permitted to use the AutoTutor after the following studies were obtained: (1) the Shipley-Hartford Word Association Test; (2) Wide-Range Achievement Test; (3) the thirty-five-item Test on Diabetes Mellitus; (4) fasting blood sugar; and (5) twenty-four-hour urine collection for quantitative glucose.

TABLE 1  
Age distribution of 105 juvenile diabetics participating in the study

Age (yr.)	No. in group	Age (yr.)	No. in group
1	1	10	9
2	2	11	22
3	5	12	8
4	4	13	10
5	1	14	10
6	4	15	7
7	3	16	6
8	6	17	1
9	5	18	1
Less than 9 yr. of age = 26			
9 yr. or older = 79			
Total = 105			

The Shipley-Hartford Word Association Test was used to evaluate general achievement levels; the Wide-Range Achievement Test permitted assessment of individual reading levels. The thirty-five-item Test on Diabetes initially administered to determine participant knowledge of the basic fundamentals of diabetes and its management has been utilized in other studies.<sup>2</sup> Repeat testing immediately after use of the AutoTutor and again three months later provided information as to whether or not knowledge had been gained and retained. Fasting blood glucose levels and twenty-four-hour urine collection for quantitative glucose were obtained at the beginning of the study; repeat tests at two weeks and at three months after use of the AutoTutor were carried out in an attempt to provide objective evidence of alteration in degree of control. Items 1, 2, and 3 were also administered to all parents and family members prior to use of the teaching machine, immediately upon completion of the programmed instruction, and three months later. All patients and family members were interviewed individually, and acceptance of machine programmed education was assessed by questionnaire.

RESULTS

Juvenile diabetics

Results of the studies were analyzed on the basis of age of the child and duration of the disease.

Age. Sixty-six children nine years of age and older used the AutoTutor and submitted to all of the required laboratory studies. For various reasons, thirteen children in the age grouping failed or refused to complete all follow-up studies. All children had their disease for six months or longer and were insulin dependent. They were cared for by thirty-five different physicians, most of whom were pediatricians and general practitioners in private practice in the Minneapolis-St. Paul metropolitan area. Sixty-one of these children demonstrated at least a fifth-grade reading level on the Wide-Range Achievement Test; five read at the fourth-grade level. Results of their scores on the thirty-five-item Diabetes Test grouped according to ages are depicted in figure 2. Scores of the test administered prior to use of the teaching machine show an over-all trend of increased knowledge which correlated closely with increasing age.

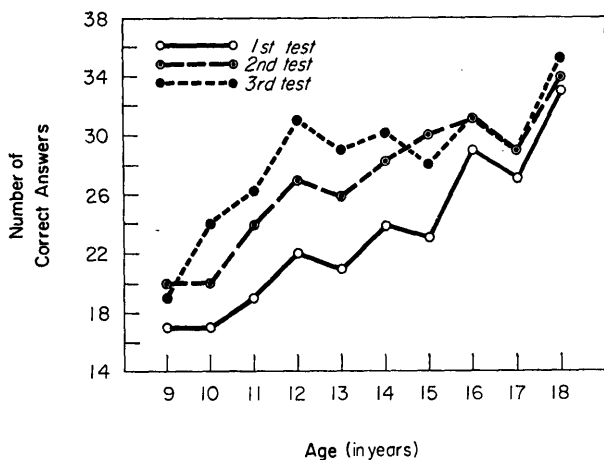


FIG. 2. Results of Diabetes Test according to age.

Results of the second test taken immediately upon completion of the programmed instruction revealed a significant gain in knowledge of diabetes among most children but was limited to certain age groupings (table 2). This increased level of knowledge was sustained in all cases as shown by repeat testing three months later. There was no significant increase or decrease in the amount of knowledge these children exhibited between the second and third diabetes tests using the p-value of .05 or less as the level of significance.

TABLE 2

Comparison of Diabetes Test results by age (p-values)\*

Test	9	10	11	12	13	14	15	16	17	18
1 vs. 2	—	—	.005	.06	.025	.02	.10	—	—	—
1 vs. 3	—	.04	.005	.01	.005	.005	—	—	—	—
2 vs. 3	—	—	—	.06	—	—	—	—	—	—

\* Listed only if p = .10 or less.

Fasting blood sugar levels of these children were compared at the onset of the study, two weeks after using the programmed instruction and again three months later. No significant differences in these values were apparent when results were submitted to statistical analysis (figure 3). In a similar manner, evaluation of the twenty-four-hour urine collections for quantitative sugar obtained at these same intervals failed to show significant variations between the pre- and postprogrammed instruction periods (figure 4).

Duration of disease. Information concerning the influence of "duration of disease" on the child's knowledge of diabetes and his ability to learn was also assessed upon paired analysis. Test results of the thirty-five-item Diabetes Test indicated children having recent onset of their disease (within six to twelve months) know more about the condition than children having the disease one to five years; this difference was apparent in all three tests (figure 5). The p-values are listed in table 3.

There was no significant difference in the test scores between children having the disease six to twelve months

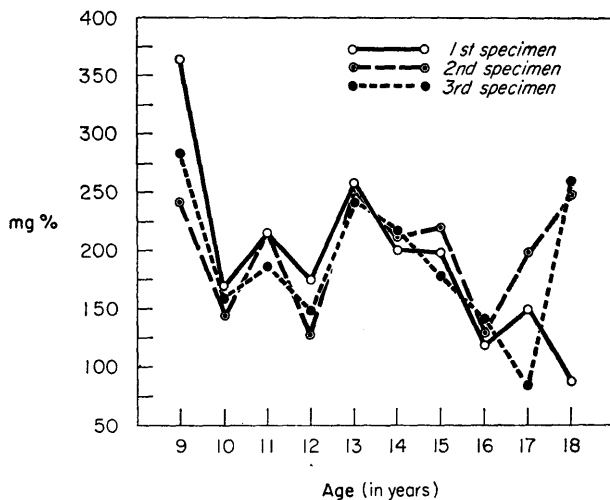


FIG. 3. Fasting blood sugar levels of participants.

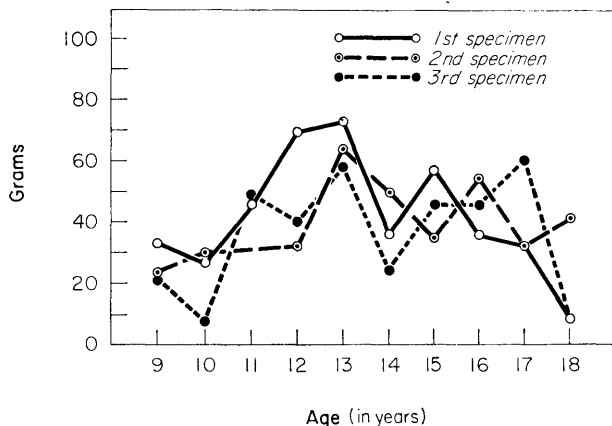


FIG. 4. Twenty-four hour quantitative urine sugar of participants.

and those having their diabetes more than five years. Comparison of scores between the one- to five-year group and the group having their disease over five years revealed no differences on the first test; however, results were different between these two groups on the second and third tests with p-values of .05 or less. There was a significant increase in knowledge of diabetes by all three groups following use of the teaching machine; only the group having their disease more than five years showed any change between the scores of the second and third tests. The average age of the children in the three groups is shown in table 4.

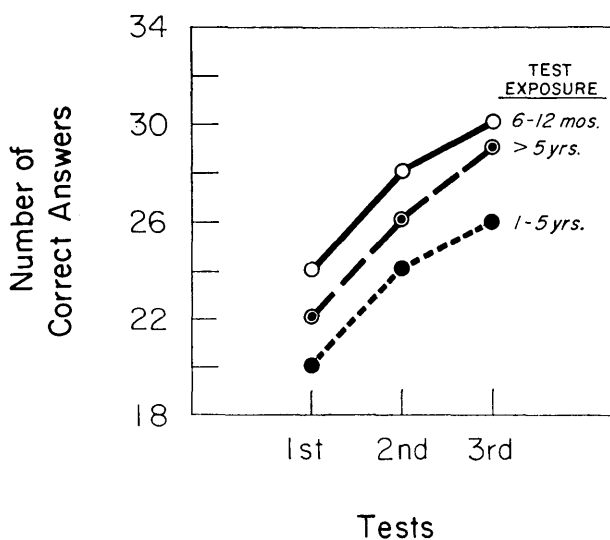


FIG. 5. Analysis of results of Diabetes Test according to duration of disease.

TABLE 3

Comparison of Diabetes Test results by duration of disease (p-values)\*

Duration	Test 1	Test 2	Test 3
6-12 mo. vs. 1-5 yr.	.05	.05	.06
6-12 mo. vs. > 5 yr.	—	—	—
1-5 yr. vs. > 5 yr.	—	.05	.04
	Test 1-2	Test 1-3	Test 2-3
6-12 mo.	.01-.02	.001-0.1	—
1-5 yr.	< .001	< .001	—
5 yr.	< .001	< .001	.02 < .05

\* Listed only if p = .10 or less.

Parent group

One hundred and sixty-three parents of juvenile diabetics initially took part in this study but only 114 completed all follow-up studies. Results of the Shipley-Hartford Word Association Test given to these parents revealed no gross deviations from normal, and the Wide-Range Achievement Test showed all reading levels to be above the sixth grade level. All parents showed a significant gain in knowledge of diabetes immediately

TABLE 4

Duration of disease and average age of juvenile diabetics

Known duration of disease	No. of children	Average age of group
6-12 mo.	6	12.2
1-5 yr.	34	12.1
5 yr.	26	12.9

after using the teaching machine, as appraised by the thirty-five-item Diabetes Test. This increase was sustained three months later as shown in figure 6. There appeared to be no significant difference in knowledge of the disease between parents of children over or under nine years of age. Fathers participating in the study scored almost as well as the mothers; however, the small number involved did not permit statistical analysis and probably represents a select group.

Acceptance

In an effort to evaluate acceptance of programmed instruction, each participant was interviewed immediately after using the machine. Children nine through twelve years of age expressed some difficulty with the vocabulary; those thirteen to eighteen years of age had no problem. Most participants felt that the number of diagrams included was sufficient. They stated that color might improve the effectiveness of the material, but did not feel the addition of sound desirable. A preference was expressed for reading this material on the

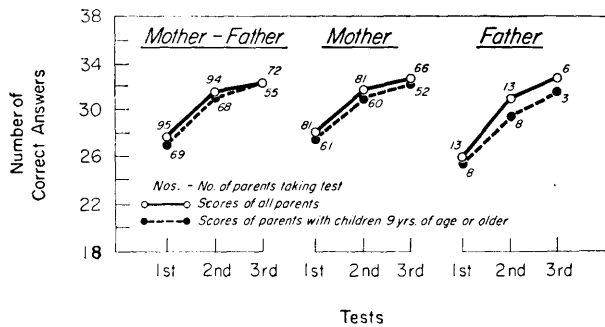


FIG. 6. Analysis of results of Diabetes Test given to parents.

AutoTutor in contrast to having it in book form. Although the participants enjoyed using the teaching machine, only one third of them stated that they would like to repeat the experience again in six months.

#### DISCUSSION

The studies described here indicate programmed instruction can increase knowledge of diabetes and its management among juvenile diabetics and their parents. Furthermore, it is of great interest that this information was retained for a period of at least three months after exposure to a teaching machine without evidence of significant "fall off."

The effect of duration of the disease upon patient knowledge is not clear from these studies. Children having their diabetes six to twelve months demonstrated a significantly greater knowledge of the disease on the first two tests than those having the disease for from one to five years. The newness of the condition and the more recent basic instruction may, in part, account for this difference. There was, however, no difference between scores of this group and those having diabetes more than five years.

There were no significant changes in the fasting blood glucose levels or the amount of urinary glucose excreted by the subjects after programmed instruction, thus increased knowledge did not result in improved control of the disease as assessed by these parameters. Other criteria for acute and long-term control were not evaluated.

Programmed education will not answer all of the needs in the field of consumer health education, but this study demonstrates it to be capable of increasing knowledge among juvenile diabetics and their parents. Use of programmed education and a teaching machine has cer-

tain advantages which include: (1) it may decrease the amount of professional time required for basic instruction of patients; (2) it can provide consistent complete programs of high quality which have been prepared by skillful and knowledgeable health educators; (3) knowledge gained by this method of instruction is apparently retained; (4) individuals can acquire knowledge at their own learning rate; (5) the material is readily available for periodic review; and (6) programmed education is still novel to most individuals and this in itself has a certain intrinsic value as a method of patient education.

Disadvantages of programmed education are:

(1) it cannot be individualized according to the needs and resources of each patient and his family members; (2) there is always the danger that programmed education may be considered and used by some as the total means of patient teaching; (3) its usage may be impersonal; (4) availability of programmed material is limited and expensive to develop; and (5) initial equipment costs are significant.

This study has demonstrated that basic knowledge of diabetes and its management can be increased and is retained after utilization of a programmed teaching machine. It would be naive to assume or suggest that an accumulation of facts by consumers will insure proper control of any disease process. Once a patient understands the nature of his disease and how it can be controlled, he must be motivated and supported to carry out proper medical management.

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