PROGRAMED INSTRUCTION: THEORY AND APPLICATION

by

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TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

Educational theorists have recently been given an impetus to evaluate critically their pedagogy as a result of a new interpretation of long known principles of learning. This new interpretation has the dynamic potential to cause a reformation of present educational methods and to effect a tremendous increase in the amount of learning acquired through the educational process. Research done in the experimental psychologist's laboratory has made evident specific techniques for efficiently controlling behavior of animals to bring about learning. The application of these techniques to human learning is called programed instruction.

The experience of actually developing programed instructional materials gives a practical and thorough understanding of the theory behind the procedure for precisely controlling behavior to establish learning. As a part of this honors project work has been done on a program to be used by mentally handicapped students. The decision to write a program for these students was prompted by an observation that the potential contribution of home economics to their education has been given little consideration. The choice of the subject matter to program was influenced by the need of mentally handicapped students for increased ease in social situations. As Johnson indicated, "...mentally handicapped children have the potential of becoming adequate social and economic members of society."[1]

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[1]G. Orville Johnson, Education for the Slow Learner (Englewood Cliffs, N. J. : Prentice-Hall, 1963), p. 9.

Table manners constitute a segment of social courtesy frequently taken for granted. Knowing how to act at the table and being able to behave in accordance with this knowledge should enhance the student's enjoyment and increase his feelings of acceptance during mealtime. An awareness of how to make a personal contribution could develop through the concrete understanding, taught by the program, of the relationship between individual courtesy and group harmony. Thus, through a program on certain aspects of table manners, the students would receive needed training in relating acceptably to other people, particularly in the practical application at the table of the abstract concepts of consideration and courtesy.

Several terms used in this paper need to be clarified. A distinction between mentally retarded and mentally handicapped children is made by Johnson: "...(Mentally retarded) includes children with mental ability from a level so low that no academic skills can be learned to levels approaching normalcy....The mentally handicapped attain a maximum mental growth between approximately 7 years--6 months and 11 years. Their grade level achievement should be from second to fourth or fifth grade level."[1] Since mentally handicapped children come under the more general classification of mentally retarded, research done with mentally retarded children has been included in this paper, though the program on table manners has been written specifically for mentally handicapped students.

In a technical discussion of programmed instruction the word frame is usually found. A frame may be described as an element of the program which 1) presents information to the student, 2) provides opportunity for the

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[1] Ibid., pp. 7-8.

information to be used in an overt response, and 3) allows the student to compare his response to the correct response.

Operant conditioning, the topic of Chapter II, is the learning theory from which programed instruction has grown. This learning theory postulated by B. F. Skinner is examined in terms of its experimental formulation and its practical application. In Chapter III a review is given of research concerning the use of programed instruction with mentally handicapped children. Chapter IV is devoted to an explanation and an evaluation of the program the writer developed. The Appendix contains the objectives and the frames of the program on table manners.

CHAPTER II

OPERANT CONDITIONING AND PROGRAMED INSTRUCTION

Skinner described in the following words a classroom demonstration in which control of behavior is brought about through reinforcement of successive approximations:

> Starting with whatever the organism brings to the experiment and reinforcing at the right times, we slowly sculpture new forms of behavior. We do this as a standard demonstration in the classroom. A pigeon is shown in an enclosure containing a food magazine. I hold a switch in my hand. The only connection between the pigeon and me is that I can press this switch whenever I want. The class selects what they'd like to have the pigeon do: come over and bow to the audience, pace a figure 8, stick its head into one of the corners of the enclosure, or something of that kind. In two or three minutes, I can usually produce the behavior specified just by pressing the switch at the right time. I pick on behavior in the direction I want and reinforce it. It occurs immediately again. I wait for a little more in the wanted direction and reinforce again. As in modelling clay there is a series of forms, perfectly continuous, leading from the original lump to the final sculpture.[1]

In describing another demonstration, Skinner clearly told what he meant by reinforcement of successive approximations:

> In another demonstration the bird is conditioned to strike a marble placed on the floor...This may be done in a few minutes by reinforcing successive steps. Food is presented first when the bird is merely moving near the marble, later when it looks down in the direction of the marble, later still when it moves its head toward the marble, and finally when it

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[1] B. F. Skinner, "Learning Theory and Future Research," Programmed Learning: Evolving Principles and Industrial Applications, ed. Jerome P. Lysaught (Ann Arbor, Mich.: The Foundation for Research on Human Behavior, 1961), p. 60.

pecks it.[1]

It is from Skinner's theory of operant conditioning, which is illustrated in the above demonstrations, that the process employed in programed instruction has evolved. Skinner arrived at his theory of operant conditioning through laboratory experiments in controlling changes in the behavior of such animals as rats, dogs, and pigeons.[2] Since he used the word operant to mean emitted responses[3], operant conditioning can be called the conditioning of emmited responses. Emitted responses are conditioned, or strengthened, when a reinforcing stimulus immediately follows the emitted response.[4] The reinforcing stimulus causes the emitted response to occur again. Skinner controlled the direction of changes in behavior of his laboratory animals by presenting a reinforcing stimulus whenever the animal emitted a response that even in the smallest way resembled the desired behavior.

Skinner stated that learning may be defined as "a change in the probability of response" when the "conditions under which it comes about" are designated. Thus the independent variables that influence probability

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[1]B. F. Skinner, "Are Theories of Learning Necessary?" Psychological Review, 57 (1950), p. 200.

[2]B. F. Skinner, "The Science of Learning and the Art of Teaching," Harvard Educational Review, 24 (1954), pp. 86-97, reprinted in Wendell I. Smith and J. William Moore (eds.), Programmed Learning: Theory and Research (Princeton: Van Nostrand, 1962), p. 23.

[3]Ernest R. Hilgard, Theories of Learning (2d ed.; New York: Appleton-Century-Crofts, 1956), p. 83.

[4]Ibid., p. 85.

of response need to be determined.[1] He also stated that operant conditioning, as described above, "simply specifies a procedure for altering the probability of a chosen response."[2] Skinner believed that theoretically, if a teacher knows the response he wants the student to make and if he can control the independent variables that are known to change the probability of the occurance of the response, he can shape the student's behavior to comply with the desired response.

The procedures and techniques for programing instruction have developed as a result of application of the above theory. The teacher writing a program would initially have to decide what response he wants the learner to possess upon completion of the program. Whatever is to be learned must be stated as a behavorial response if successive behavorial steps in the direction of the terminal response are to be reinforced. The person writing the program must also determine the independent variables that he can manipulate to reinforce the successive behavorial steps. In addition, he must structure the successive steps leading to the terminal behavior and guide the learner through these steps. The writing of a program is a substitute for observing the learner's behavior and reinforcing any small step taken toward the desired behavior.

Determining the independent variables that will provide reinforcement to a human learner for exhibiting each successive step is a continuing research

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[1]Skinner, "Are Theories of Learning Necessary?", p. 199.

[2]Ibid., p. 200.

problem.[1] Skinner believed, when he introduced programed learning in 1954, that immediate knowledge of having made a correct response would sufficiently reinforce the response for learning to take place.[2] That is, knowing that the correct response had been made once caused an increase in the probability that the response would occur again. Thus Skinner contended that the successive steps toward the terminal behavior should be so small that failure to complete a step correctly is highly unlikely.[3] Just as Skinner gave reinforcement to his pigeons when they displayed desired behavior and withheld reinforcement when behavior not in the desired direction was shown, he would insure with small steps that students give behavior only in the desired direction. Reinforcement of desired behavior would take place; since no undesirable behavior would be exhibited, reinforcement of undesirable behavior would be withheld. Reinforcement as used in programing also makes another contribution to the learning taking place. The frequency of reinforcement occuring in a program made up of small successive steps enables complex patterns of behavior to be maintained in strength at each step. Skinner stated: "By making each successive step as small as possible, the frequency of reinforcement can be raised to a maximum while the

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[1]Lloyd E. Homme, "Laboratory Experiments and Programed Instruction," Programed Instruction, Vol. 3, No. 6 (March, 1964), p. 3.

[2]Skinner, "The Science of Learning and the Art of Teaching," p. 24.

[3]Edward B. Fry, Teaching Machines and Programmed Instruction (New York: McGraw-Hill, 1963), p. 4.

possibly aversive consequences of being wrong are reduced to a minimum."[1] Here the teacher has a systematic and experimentally based means for establishing learning in a student.

For learning to take place as outlined above, one teacher must interact with one student. In order for this to be possible, the teacher consists of programed material, arranged in small, sequencial steps, each of which is reinforced as the student responds. When the student has responded his way through the steps, he has the terminal behavior within his behavorial repertoire. This behavorial repertoire is commensurate with that desired by the person manipulating the reinforcement.

Glaser defined programing as "...the process of constructing sequences of instructional material in a way which maximizes the rate of acquisition and retention, and enhances the motivation of the student."[2] How can material be sequenced to "maximize the rate of acquisition and retention"? How can material in sequential form "enhance the motivation of the student"? According to Skinner, the consquences of any behavior emitted by an organism determine whether the behavior is repeated or is not repeated by the organism. Possibly, then, the maximization of the rate of acquisition and retention is continuously taking place as reinforcement of emitted responses establishes the student's behavior. In justifying particularly the claim to a maximized rate of retention, a statement of Skinner's concerning continued reinforcement of desirable behavior of a pigeon can be used. He said that after the

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[1]B. F. Skinner, "Some Contributions of an Experimental Analysis of Behavior to Psychology as a Whole," The American Psychologist, 8 (1953), p. 71.

[2]James G. Holland, "Teaching Machines: An Application of Principles From the Laboratory." Programmed Learning: Theory and Research. Edited by Wendell I. Smith and J. William Moore. Princeton, N. J.: Nostrand, 1962. pp. 34-48.

pigeon acquires the behavior further reinforcements maintain it as part of the current repetoire of the pigeon; no further reinforcement causes extinction of the behavior.[1] If reviews of material already reinforced are included in the program, retention could be maximized, when the reviews are spaced to give further reinforcement at the optimum time and place. Glaser's definition also gives rise to the discussion of the student's progress through a program. Each student sets his own pace as he works through the program. Thus the student, as well as the structure of the program, influences the rate of acquisition and retention. The student possibly, by advancing according to the speed of his responses, receives the rate of acquisition and retention that is optimum for him. The program requires the student to set his own pace since he must respond to one small step before he goes on to the next step.[2] The program must enable the student to exhibit each of the small, progressive steps in order that they be reinforced. The opportunity for an overt response using the information presented to him requires the learner to incorporate the information into his behavior. The behavorial response whcih he makes will be compared immediately to the correct response for that step, since reinforcement, to be effective, should

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[1]B. F. Skinner, "Some Contributions of an Experimental Analysis of Behavior to Psychology as a Whole," The American Psychologist, 8 (1953), p. 71.

[2]James G. Holland, "Teaching Machines: An Application of Principles From the Laboratory," Proceedings of 1959 Conference on Testing Problems (Princeton: Educational Testing Service, Programmed Learning: Theory and Research (Princeton: Van Nostrand, 1962), p. 38.

closely follow the response.[1] When each step is small enough for the student to exhibit the correct behavior, this correct behavior is reinforced through immediate comparison with the desired behavior for that step.

As the effect of programed materials upon the concentration of the student is explored, an explanation of how motivation is enhanced evolves. If the student knows that he will immediately compare his answer to the correct answer, he will be more inclined to concentrate on the information presented to him. In Skinner's words, immediate reinforcement "encourages a more careful reading of the programmed material than is the case in studying a text where the consequences of attention or inattention are so long deferred that they have little effect on reading skills."[2] Thus the student is directly involved in the teaching-learning process through response and reinforcement; he is less likely to be distracted from his involvement. As he makes his responses, the student in a sense involves himself in the program rather than having another person constantly directing his attention to his work. The teaching-learning interaction is between the individual student and the program. The mechanics of the program demand his involvement, but at the same time the student, through responding, is responsible for his progress through the program.

The involvement of the student in the learning process is also increased by the fact that the student knows just what he is to do as he responds his way through the program. Explicit directions for working through the program

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[1]Fry, op. cit., p. 49.

[2]B. F. Skinner, "Teaching Machines," Science, 128 (October 24, 1958), p. 975.

have been given to him.[1] He also should know each answer he is to give if the program has been effectively written according to Skinnerian programing principles.

At the same time that the student is concentrating on the material presented, he is motivated to work carefully for the correct answer.[2] The gradual progression in small steps with overt responses required and with correct answer reinforcement presented are thus characteristics of a program that increase student concentration and motivation. Skinner stated that "the arrangement of contingencies of reinforcement" produces effects "traditionally assigned to the field of motivation." One of these effects is to produce a certain performance with a given schedule of intermittent reinforcement; another is to maintain a given behavior over a period of time.[3]

In learning situations other than those set up by a program, such as hearing a lecture, the student has little or no opportunity to make a response and have it confirmed. Glaser reasoned that "failure to strengthen behavior of a student with respect to the subject matter often results in the student showing a lack of interest....his interest is shifted to other activities for which sufficient reinforcement is provided."[4] As has been brought out

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[1]Fry, op. cit., p. 87.

[2]Ibid., p. 34.

[3]Skinner, "The Science of Learning and the Art of Teaching," p. 20.

[4]Glaser, op. cit., p. 22.

above, a program demands a student's attention and participation, and immediately reinforces his behavior.

In reference to the building up of a behavorial repertoire mentioned earlier a further clarification follows. Skinner stated: "The goal is not to build up the verbal repertoire itself, but to make sure that the student can correctly describe a state of affairs with responses already available in his repertoire with respect to similar states of affairs".[1] The goal is thus to " 'enrich the student's understanding' by inducing him to permute and recombine the elements of his repertoire." This goal is accomplished by varying the syntactical frames of the responses, with the student learning to translate a "fact" from one syntax to another.[2] As the programer uses different contexts for the same fact, Glaser stated that "the student receives new information, he learns to make finer discriminations, and learns to apply what he has learned to a wide variety of situations."[3] The student may also develop abstractions and intricate concepts through the sequencing of examples.[4] A program written with these goals in mind and employing a variety of contexts that will attain the goals has the potential for teaching

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[1]B. F. Skinner, "The Programming of Verbal Knowledge," Automatic Teaching: The State of the Art, ed. Eugene Galanter (New York: Wiley, 1959), p. 66.

[2]Ibid., p. 65.

[3]Glaser, op. cit., p. 35.

[4]Ibid., p. 36.

what Whitehead calls facts arrayed with all of their possibilities.[1]

Psychologists who subscribe to the operant conditioning theory of learning believe that the behavior of an individual gives the only evidence of what he is learning and what he has learned. The degree of learning or effectiveness of teaching can be accurately determined by measuring this behavior against a given criterion of acceptable behavior. In order to examine the effectiveness of any teaching, the examiner must make sure that the learner has experienced the teaching. He then compares the desired criterion with the learner's behavior. Thus the teacher or examiner faces a two-part problem: 1) how to teach so that the learner will exhibit the criterion behavior, and 2) how to insure that the learner experiences the teaching. An answer to this problem is supplied through programed instruction. The requiring of overt responses allows the student to exhibit the criterion behavior and at the same time insists that he experience the teaching. The learning environment structured to lead the student gradually into the terminal behavior has large possibilities for proving, with the student's responses, that it provides an effective means for teaching.

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[1]A. N. Whitehead, Science and the Modern World, (New York: MacMillian, 1925), p. 198.

CHAPTER III

MENTALLY HANDICAPPED STUDENTS AND PROGRAMED INSTRUCTION

Programed instruction could be successfully employed in the classrooms of mentally handicapped children just as it has the potential for successfully teaching classes of normal children. Educable mentally handicapped children learn as normal children do, through experience, but their rate of learning is slower and they usually learn less, especially in academic areas.[1]

Because their rate of and capacity for learning differ from that of the majority of children in a regular class, the mentally handicapped are placed in special classes. Kirk and Johnson gave as the main considerations for the placement of the mentally handicapped in special education classes the inability to "profit sufficiently from the curriculum of the regular schools and ... (the need for) a special curriculum for their social and occupational growth."[2] Kirk characterized the educable mentally handicapped child for whom special education classes are formed as follows:

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[1]Herbert Goldstein and Dorthy M. Seigle, The Illinois Plan for Special Education of Exceptional Children, A Curriculum Guide for teachers of the Educable Mentally Handicapped (Illinois Department of Public Instruction: Circular Series B-3, No. 12, 1958; Chicago: Illinois Council for Mentally Retarded Children), p. 5.

[2]Samuel A. Kirk and G. Orville Johnson, Educating the Retarded Child (Cambridge: Houghton Mifflin, 1951), p. 11.

1) An I.Q. on individual tests of about 50 to 80.

2) Retardation of three or more years in the educational tool subjects at the secondary school age.

3) A prognosis that he could, through proper education, become socially acceptable and competent in managing his own affairs.

4) A prognosis that he will be able to hold a job and support himself partially or totally.[1]

The use of programed instruction with mentally handicapped students is being investigated in current research as a means of increasing the efficiency of their education. Learning characteristics of these children seen in relation to the learning conditions set up by programed materials suggest that programed instruction may improve their education. As was mentioned above, the mentally handicapped child is like the normal child in that they both learn from experience. Learning characteristics that differentiate him from the normal student include oversimplification of concepts, limited ability in generalization, short memory and attention spans, and limitations in incidental learning.[2] The theoretical improvements in education discussed in Chapter II are inherent in the learning environment created by a good program. Thus a good program could minimize the learning disabilities of mentally handicapped students and thereby increase the efficiency of their education. Research and

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[1]Samuel A. Kirk et al., Educating the Mentally Handicapped in Secondary Schools (Illinois Secondary School Curriculum Program: Circular Series A, No. 51, Bul. No. 12; Springfield, Ill.: Office of State Superintendent of Public Instruction, January 1951), p. 10.

[2]Goldstein and Seigle, op. cit., p. 14.

writing support the idea of programed instruction making a large contribution to the education of mentally handicapped students.

In constructing programs to be used by students in special education classes, the question arises as to whether mentally handicapped students require programs that differ from those used by students with higher scores on general intelligence tests. Stolurow, in reviewing Woodrow's argument, reported that "ability tests predict the initial level of performance but not the gain scores in learning tasks. The variance in gain scores on learning tasks is not correlated with general ability tests scores and general intelligence is not synonymous with learning ability."[1] Stolurow also reports Woodrow's conclusion that "factors totally uncorrelated with general intelligence have as much to do in determining achievement as has intelligence."[2] Stolurow then gives his own interpretation of the research findings:

> . . . . although general intelligence test scores are an index of the level of task difficulty that the learner can master, they do not predict the rate at which he will master those tasks. Individual differences in rate of learning apparently are a function of a number of separate factors; e.g., motivation, immediate memory span, cue attention habits.[3]

It may be concluded that intelligence scores may indicate the maximum level of task difficulty that the student has the ability to learn but they do not

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[1]Lawrence M. Stolurow, Teaching by Machine (U. S. Department of Health, Education, and Welfare; Cooperative Research Monograph No. 6; Washington: U. S. Government Printing Office, 1961), p. 52.

[2]Ibid., p. 53.

[3]Ibid.

indicate how fast or how well he will learn to do the task. If the task to be programed is within the maximum level of task difficulty indicated by the general intelligence scores of the students, the program itself can determine to some degree the rate and strength of learning that takes place.[1] The program is able to affect the rate and strength of learning in the degree that it positively channels and takes into account motivation, immediate memory span, cue attention habits and other factors uncorrelated with general intelligence.

Stolurow pointed out that since research indicates a lack of correlation between general intelligence and gain scores on learning tasks, the assumption that different programs must be written for students with different ability levels appears unsupported.[2] Furthermore, he reported that with efficient programing the "correlation between measure of intellectual ability or aptitude and learning scores tends to be reduced to zero".[3] According to Stolurow, separate programs do not seem to be necessary even for complex tasks, since "the main differentiating factors may be differences in motivation, in past experience, and in degree of familiarity or in the meaning of the symbols used rather than in the problem-solving ability itself."[4]

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[1] Ibid., p. 54.

[2] Ibid., p. 52.

[3] Lawrence M. Stolurow, "Teaching Machines and Special Education," Educational and Psychological Measurement, 20 (1960), p. 438.

[4] Stolurow, Teaching By Machine, p. 59.

Again the program through the control of factors extraneous to general intelligence does not have to be constructed differently for different ability levels.

The above paragraphs introduce a concept which can be built upon to provide programs that teach mentally handicapped students. Though no distinction is made according to ability, consideration has to be given, however, to the wording of the program. The reading vocabulary and the reading comprehension scores of the student give some idea of his reading level. The relation between the reading level of the program and the reading level of the student affects the amount of learning acquired with the program.[1]

Studies evaluating the use of programed instruction with mentally retarded students give concrete information concerning the effectiveness of programed materials. Price compared three methods of teaching principles of addition and subtraction to mentally retarded students: conventional teaching, and programed instruction of both 1) answer-construct and 2) multiple choice types. He found that pre-test and post-test scores showed no significant differences between groups in amount learned, other than the significant differences in subtraction as learned by the multiple choice group.[2]

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[1]Glen Phillip Cartwright, "Two Types of Programmed Instruction for Mentally Retarded Adolescents" (unpublished Master's thesis, University of Illinois, 1962), p. 31.

[2]James E. Price, A Comparison of Automated Teaching Programs with Conventional Teaching Methods as Applied to Teaching Mentally Retarded Students (National Defense Education Act of 1958: Title VII, Project No. 670; Tuscaloosa, Ala.: Partlow State School and Hospital), p. 7.

Malpass compared the relative effectiveness of multiple choice-type and modified completion-type programed materials in teaching word recognition, reading and spelling skills to retarded children. The effectiveness of these two procedures was compared with classroom instruction for mentally retarded children.[1] The multiple choice and modified completion groups had significantly greater gains in learning word recognition and spelling than the conventional classroom group. The retention rates for both automatic instruction procedures were substantial though there was no significant difference in retention among the three types of teaching.[2] However, spelling skills were the exception in that they improved, but had low retention through automatic instructional methods.[3] The outstanding finding in relation to time was that pupils using programed materials more than doubled in eight weeks the gains made in four to ten years of public school class instruction. Less than 5 per cent of the students in the conventional classroom doubled in word gains during the eight weeks.[4] These studies give support to the idea of using programed materials to teach mentally retarded students more effectively and in less time than when conventional classroom methods are used.

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[1]Leslie F. Malpass (Project Director), Comparison of Two Automated Teaching Procedures for Retarded Children (U. S. Department of Health, Education, and Welfare: Cooperative Research Project No. 1267; Tampa, Fla.: University of Southern Florida, 1963), p. 14.

[2]Ibid., p. 60.

[3]Ibid., p. 61-62.

[4]Ibid., p. 62.

Stolurow suggested two possible causes for the contrast between the rate at which mentally retarded children learn and that at which normal children learn. One of these is concerned with the fact that programed materials give cues to the student to guide him in the step by step development of the subject matter. In other teaching materials these cues are not provided and students may not see the gradual and unifying development. Mentally retarded children would be even less likely to see this development than normal children, and thus would learn the material at a slower rate.[1] The other possible cause takes into account the fact that programed materials point out to the child exactly what he will be responsible for, thereby helping him to discover to what he should give his attention. Other learning materials give the student little or no direction toward required responses and leave him on his own to give his attention to what he considers most important.[2] Mentally retarded children may make greater errors than normal children in selecting, on their own, what is most important.

Stolurow's suggested causes behind differing rates of learning for mentally retarded and for normal children lead one to speculate that these same causes account for the increase in learning gains, in decreased time, when programed materials were used with mentally retarded children in Malpass's study. The guides to the sequential development and for the

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[1]Stolurow, "Teaching Machines and Special Education," p. 432.

[2]Ibid., p. 433.

discovery of responses inherent in programed materials could save the mentally retarded child time and effort in determining what is important and in seeing the material as a unit.

Programed instruction does seem to have a contribution to make to the education of mentally handicapped children. As indicated above, studies conducted to determine the effectiveness of programed instruction for teaching mentally retarded children agree in two overall conclusions: 1) programed materials can teach at least as well as conventional methods; and 2) learning resulting from programed instruction takes place in less time than an equal amount of learning accomplished through conventional classroom procedures.

CHAPTER IV

A PROGRAM FOR MENTALLY HANDICAPPED STUDENTS

The program that has been developed for use by students in special educations classes is intended for use as beginning lessons in basic table manners. It is written for students who have had little or no previous training at home or in class in elementary table etiquette. The order of steps and the procedure for each step used in constructing the program came largely from Lysaught and Williams, A Guide to Programmed Instruction.[1] Though a complete record of the steps taken is not given, several major steps are discussed: the formulation of objectives, the testing and revising of frames, and the future expansion of the present program.

The specific aspects of table manners delineated in the objectives of the program are fundamental points of table courtesy. The objectives consist of the total terminal behavior broken into small segments that tell exactly what the learner will do when he exhibits each action making up the total behavior. Mager's final summary in Preparing Objectives for Programmed Instruction states a standard for objectives:

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[1]Jerome P. Lysaught and Clarence M. Williams, A Guide to Programmed Instruction (New York: Wiley 1963).

1) A statement of instructional objectives is a collection of words or symbols describing one of your educational intents.

2) An objective will communicate your intent to the degree you have described what the learner will be DOING when demonstrating his achievement and how you will know when he is doing it.

3) To describe terminal behavior (what the learner will be DOING):

   a. Identify and name the over-all behavior act.

   b. Define the important conditions under which behavior is to occur (given and/or restrictions and limitations).

   c. Define the criterion of acceptable performance.

4) Write a separate statement for each objective; the more statements you have, the better chance you have of making clear your intent.

5) If you give each learner a copy of your objectives, you may not have to do much else.[1]

It might be added that the final form of the objectives of a program evolves as the program itself is written and revised. The objectives included in the Appendix reflect the present developmental state of the program.

Since the frames of the program have been revised on the basis of the reactions of students, description of the sessions held with them and discussion of the students' characteristics has been included. The individual sessions for testing the frames were about thirty minutes in length. Before one of the four girls began working through the frames, it was pointed out to her that she was helping to develop the program and that

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[1]Robert F. Mager, Preparing Objectives for Programmed Instruction (San Francisco: Feron, 1961), p. 53.

revisions would be made according to her responses and comments. It was also made clear that any wrong responses were caused by a mistake on the part of the programer and were not a reflection on the student.[1] Wrong responses indicated to the programer the need for clarification or for smaller steps and were thus a help in improving the program for later students. Lumsdaine pointed out that when revisions are based on reactions of students, the students become co-authors of the program.[2] The girls were told to feel free to comment if they did not understand words used or the phrasing of sentences. Each girl spoke her responses, rather than writing them in the blank, in order for the same frames to be used by others. After a girl had worked through a group of frames for about fifteen minutes, a conversation followed concerning the frames, their content, and the student's previous training in the aspects of table manners in the frames.

The four girls who worked through the frames were members of high school special education classes; two were freshmen and two were sophomores. Data indicating their academic aptitudes and reading levels are reported in Table I. The reading level scores were obtained using the Stanford Achievement Test, Elementary Battery, form L, which was administered a week and a

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[1]James G. Holland, "Teaching Machines: An Application of Principles From the Laboratory," Proceedings, 1959 Conference on Testing Problems (Princeton: Educational Testing Service, 1959), reprinted in Wendell I. Smith and J. William Moore (eds.), Programmed Learning: Theory and Research (Princeton: Van Nostrand, 1962), p. 44.

[2]Arthur A. Lumsdaine, "Teaching Machines and Programmed Instruction," New Methods and Techniques in Education, Educational Studies and Documents No. 48 (Paris: UNESCO, 1963), p. 31.

half after the sessions for testing the frames ended. The academic aptitudes scores of Subjects 1 and 2 were measured by the Stanford-Binet test and those of Subjects 3 and 4 by the Wechsler Intelligence Scale for Children.

TABLE I

ACADEMIC APTITUDE AND GRADE EQUIVALENTS OF ACHIEVEMENT SCORES*

		Stanford Achievement Test, Elementary Battery		
Academic aptitude (I Q)		Paragraph Meaning	Word Meaning	Average Reading
Subject 1	54**	3.7	2.8	3.3
Subject 2	48**	2.6	3.2	2.9
Subject 3	62***	5.5	3.9	4.7
Subject 4	57***	4.3	3.9	4.1

* Data obtained from Frances Pollock, Northeast High School, Guilford County, North Carolina

** Measured by Stanford Binet

*** Measured by Wechsler Intelligence Scale for Children

The average reading scores of the four students ranged from second grade, ninth month to fourth grade, seventh month. When the frames of the program were being written, an attempt was made to use approximately a third grade reading level. References for insuring the use of a third grade reading

level included vocabulary lists and reading texts.[1] However, some words, such as fork, knife, and fingers, were left in the program though they are not in the reference lists or texts. These words were found to be familiar to the girls who worked through the frames, with no additional teaching of them appearing necessary. While these words are not found in third grade reading books, their presence in the reading vocabularies of the four girls possibly results from the past daily experiences of the girls rather than just through their level of attainment to date in reading. As for the consideration given to the sentence structure used in the frames, a source of guidance, in addition to the reading texts, was the statement from an interview with a teacher of special education classes that her students understood simple sentences much better than complex ones.[2] The use of modifying clauses was kept to a minimum in the frames, and simple, straightforward sentences were written. The four girls had some difficulty with sentences used initially in the frames.

The most significant revisions made as a consequence of the girls' reactions were ones in which phrases and words were clarified. When a student made an incorrect response, unclear phrasing in the frame was usually responsible. Most of the words used in the frames were present in the

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[1]William S. Gray, A. Sterl Artley, and May Hill Arbuthnot. The New More Friends and Neighbors (1952). The New More Streets and Roads (1953). The New Streets and Roads (1952). (Chicago: Scott Foresman).

[2]Interview with Hope Harmon, home economics teacher in special education, Philo Junior High, Winston-Salem, North Carolina, November 12, 1963.

vocabularies of the girls. The girls indicated any words that were not familiar to them, and consideration was given the words in revising the frames.

Since these girls had all had some instruction in table manners in regular or in special education classes, and since at this stage of developing the program, no test for learning gains was given, there is no evidence of how much the girls learned. It has been ascertained through the testing sessions that special education students with a reading level of approximately third grade can read the frames, and can give correct responses when they are working through the program. Some of the frames included in this paper, however, have not been re-tested with students since they were revised. The program is recorded in the Appendix.

The writer gained access, after the testing of the frames, to suggestions for appraising frames and examples of faulty frames.[1] An evaluation of the present state of the frames indicates the directions to be taken in improving them. Technical flaws which lessen the effectiveness of the frames include: 1) the presence of "copy frames" in which the student can merely fill in the blank without actually comprehending the information presented[2]; 2) the use of irrelevant words for responses, resulting in the

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[1]A series of articles entitled "Faulty Frames" appeared in the early issues of Programed Instruction, Vol. 1, Nos. 1-6.

[2]Bernard Basescu pointed out the danger of using copy frames with retarded children when he said that "retarded children learn even less from copy frames, since brighter children sometimes take the trouble to read material to which they have not been asked to respond." Bernard Basescu, "The Curse of the Copy Frame," Programed Instruction, Vol. 3, No. 5 (May, 1963), p. 4.

student practicing a response that is not the one to be acquired; 3) an insufficient amount of variety and vitality in the form, wording, and contexts used to present the information and to require responses. With further improvement along these three lines, the frames will have greater potentiality as teaching materials.

In expanding the objectives that these frames are to teach, four additions in particular need to be incorporated: 1) if a blessing is said at the table, it will be done before the napkin is picked up; 2) if unsure of what to do at any time, the student can watch the Mother and do what she does; 3) the "boss" of the table may not always be the Mother of the family but is any person who leads the meal; 4) the procedure for cutting meat if a person is left handed. Another addition to the program under consideration is the use of stick figures on frames to increase clarity and variety. Stick figures, rather than actual drawings of people, were suggested in an interview with a director of special education for the reason that less negative identification can take place with impersonal stick drawings.[1] In later improvements upon the program, words with less authoritarian connotation may be substituted for "boss". Such words which might convey the idea of "hostess" with more clarity include "leader" and "guide".

There are other aspects of basic table manners that could be included in the final program. Behavorial objectives for these would be:

1) After finishing the meal, the student replaces the napkin, not folded, to the left of his plate, after he sees the "boss" replace her napkin.

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[1]Interview with Evelyn Boyd, Director of Special Education, Guilford County Schools, November 21, 1963.

2) The student uses both hands when he butters bread; this is a situation which is one of the exceptions to his keeping one hand in his lap most of the time.

3) The student uses a fork to pick up all foods except sandwiches, bread, cookies, potato chips, carrot strips, or celery sticks, for which he uses his fingers.

4) The student keeps his elbows off the table; he does not prop them on the table and lean on them.

5) The student cuts a bite of meat by moving the sharp edge of the knife back and forth in front of the tines of the fork.

6) After the student has cut only one or two bites, he stops cutting.

7) He then places the knife across the right top edge of his plate.

8) He transfers his fork from his left hand to his right hand, and picks up a bite of meat with his fork.

9) The student repeats the entire sequence of meat-cutting actions when he later cuts another bite of meat.

These objectives are a continuation of those already programed and they are a means of enlarging the number of aspects of basic table manners taught by the program.

Future development of the program will necessitate having a whole class of special education students work through the frames. The program will then be revised according to the reactions of this larger number of students. A post-test will later be devised to measure learning gains. It is planned that for this post-test a performance test would be practical, requiring the students to exhibit at the table behaviors established by the program. If a practical test were used, practice of the actual behaviors, in addition to written responses of the behaviors, possibly would need to be built into the program.

The frames, as they are at present, have the untested potential for efficiently establishing behaviors in mentally handicapped students that will increase their ease and enjoyment of the social situation during mealtime.

APPENDIX

Objectives And Frames Of
A Program On Table Manners
For Mentally Handicapped Students

OBJECTIVES OF A PROGRAM ON TABLE MANNERS

The learner will abide by the following rules of table etiquette which will give him ease in the social situation of mealtime.

1. When the student sits down at the table he watches the mother or "boss" who will show him what to do first.
2. The student does what the mother does after the mother does it.
3. After the mother picks up her napkin and places it in her lap, the student picks up his napkin and places it in his lap.
4. When the student sees Mother start to eat he may start to eat.
5. The student wipes his lips, not his cheeks, with a part of his napkin.
6. The student lifts his napkin from his lap to his lips with one hand.
7. The student keeps his napkin in his lap during most of the meal; he may wipe his fingers on the napkin when the napkin is in his lap.
8. The student uses only the space in front of his chair for his arms; he does not put his arms into the space in front of someone else's chair.
9. If the student wants something that is in the space in front of someone else's chair, he may get it by asking the person to pass it to him.
10. The student helps make mealtime pleasant by (8) and by keeping his arms close by his sides; he does not wave his arms around or stretch them overhead.
11. The student puts food into his mouth in small amounts; he does not stuff his mouth full.
12. The student chews with his mouth closed.
13. The student's mouth is closed whenever he has food in it.

14. When talking at the table, the student has his mouth empty of food.
15. If someone speaks to the student while his mouth contains food, the student makes a motion with his finger to indicate that he will speak (answer) when his mouth is empty.
16. The student then waits to speak when his mouth is empty.
17. The student speaks in a soft voice at the table to make mealtime more pleasant; he does not speak loudly.
18. The right-handed student holds the fork in his right hand most of the time.
19. He usually has his left hand in his lap.
20. The student takes his left hand out of his lap when he starts to cut a bite of meat.
21. The student puts his fork into his left hand and then picks up the knife with his right hand.
22. The student holds the fork by the handle, putting the tines into the meat to hold it firmly in place.
23. The student holds the fork with the tines pointing down and the back of the fork turned upward.
24. When holding the fork, the student's first finger presses down on the back of the fork; his thumb is placed under the fork handle and presses against the handle; his other fingers are wrapped around the fork handle.
25. The student holds the handle of the knife in his hand, with the sharp edge pointing down to the plate.
26. The student holds the knife with his first finger on the top edge of the handle, near where the blade starts; he has his thumb along the side of the handle; his other fingers are curled around and under the handle.

FRAMES OF A PROGRAM ON TABLE MANNERS

1. It is lunch time. Mother, Father, Bill, and Judy come to the table. They have come to eat lunch at the _____. table

2. Everyone sits down. Father, Bill, and Judy look at Mother.
Father, Bill, and Judy are sitting at the table looking at M _ _ _ _ r. M o t h e r

3. Father, Bill, and Judy do not start to eat. They look at Mother.
Father, Bill, and Judy sit at the table looking at _____. Mother

4. Father, Bill, and Judy look at Mother because Mother is the first person to eat at the table.
Everyone looks at Mother because she is the _____ person to eat. first

5. No one starts to eat. Father, Bill, and Judy wait for Mother to start to eat.
The first person to eat is _____. Mother

6. Father, Bill, and Judy wait for Mother to start eating because Mother is the "boss" of the table.
Father, Bill, and Judy look at Mother who is the "b _ _ _ " of the table. "b o s s"

7. As the "boss" of the table, Mother shows everyone when to start to eat.
Mother shows everyone when to eat because she is "____" of the table. boss

8. When Father, Bill, and Judy see Mother start to eat, they will start to eat.
Everyone does what Mother does because _____ is the "boss" of the table. Mother

9. Father, Bill, and Judy look at the "boss" to see what she does first.
Everyone looks at the "boss" to see what she does _____. first

10. Mother picks up her napkin. Father, Bill, and Judy see that first Mother picks up her _____. napkin

11. The first thing Mother does is to pick up her _____. napkin

12. Mother picks up her napkin and she places it in her lap.
Mother now has her napkin in her ___. — lap

13. Father, Bill, and Judy see the "boss" of the table pick up her napkin and place it in her lap. Each one now picks up his napkin because he sees the "boss" pick up her _____. — napkin

14. Father, Bill, and Judy now place their napkins in their laps because they see the "boss" place her napkin in her _____. — lap

15. After Mother picks up her napkin and places it in her lap, Father picks up his napkin and places it in his _____. — lap

16. Bill picks up his napkin and places it in his lap after he sees _____ place her napkin in her lap. — Mother

17. Now Judy does just what the "boss" did. Judy picks up her _____ and places it in her _____. — napkin, lap

18. Everyone at the table has his napkin in his lap. They look at the "boss" to see what she does next. — (no response)

19. The next thing Mother does is to start to eat.
Father, Bill, and Judy see Mother start to ____. — eat

20. When Father, Bill, and Judy see Mother start to eat, they can start to eat because Mother is the " ____ " of the table. — boss

21. Let us watch to see what Mother does with her napkin while she is eating. — (no response)

22. Most of the time Mother has her napkin in her lap.
Mother keeps her napkin in her lap _____ of the time. — most

23. Some times she wipes her fingers on her napkin while the napkin is in her lap.
If Mother has grease on her fingers, she can wipe them on her napkin while it is in her _____. — lap

24. Mother uses her napkin to wipe food off her lips.
Mother can take her napkin from her lap to wipe her _____. lips

25. Mother takes her napkin from her lap and places only part of her napkin on her lips.
Mother wipes her lips with only _____ of her napkin. part

26. Mother does not wipe her lips with all of her napkin. Only part of her napkin touches her lips.
Mother touches her lips with only _____ of her napkin. part

27. Mother wipes only her lips. She does not wipe her cheeks with her napkin.
Mother's napkin touches only her lips. It does not touch her _____. cheeks

28. When she wipes food off her lips, Mother takes her napkin from her lap with one hand.
Mother lifts her napkin from her lap to her lips with _____ hand. one

29. Mother does not use two hands to take her napkin from her lap to her lips. She uses only ____ hand. one

30. Father, Bill, and Judy will use their napkins just as they see Mother use her napkin because Mother is " _____ " of the table. boss

31. Father will keep his napkin in his lap _____ of the time. most

32. If Judy gets food on her fingers, she can wipe them on her napkin in her _____. lap

33. Bill takes his napkin out of his lap to wipe food off his _____. lips

34. Bill spreads out his napkin and wipes all of it across his lips.
Is Bill doing what the "boss" did?

If you said yes, you are not right and we need to look again to see what the boss does.

If you said no, you are right. Let us look again to see the boss wipe her lips.

35. Mother wipes her lips with only part of her napkin. She did not wipe all of it across her lips.
Bill now sees that he should wipe his lips with _____ of his napkin.

part

36. When Father uses his napkin, he wipes only his _____, not his cheeks.

lips

37. When Judy lifts her napkin from her lap to her lips, she will use _____ hand, not two hands.

one

38. Let's find out where a person keeps his arms when he is at the table.

(no response)

39. At the table each person can use the space in front of his chair.
When a person moves his arms at the table, he should use only the space in _____ of his chair.

front

40. The space in front of each chair is used only by the person sitting in the chair.
The only person using the space in front of Judy's chair is _____.

Judy or "her"

41. A person sitting in one chair does not use the space in front of another chair.
Judy and Bill are sitting beside each other at the table. Judy does not reach her arm into the space in front of _____'s chair.

Bill

42. Each person keeps his arms within the space in front of his chair.
Judy does not move her arms out of the space in _____ of her chair.

front

43. What does Judy do if she wants the salt which is sitting in the space in front of Bill's chair?

If you said that Judy asks Bill to pass the salt to her, you are right!

If you said that Judy reaches for the salt, you are wrong. If Judy reaches, she is using the space in front of Bill.

44. Let's see what Judy would do if she wants something that is sitting in the space in front of Bill.

(no response)

45. When you want something that is sitting in the space in front of another person, you cannot reach into the space and get what you want.
Since the salt is sitting in front of Bill, Judy does not _____ over to get it.

reach

46. When you want something that is sitting in the space in front of another person, you ask the person to pass to you what you want.
Judy can ask Bill, "Would you please _____ the salt to me?"

pass

47. By asking someone to pass to you what you want, you do not have to reach into the space in front of the person.
Judy can get the salt without reaching into the space in front of Bill by _____ Bill to pass it.

asking

48. At the table each person should help to make mealtime pleasant for every other person.
By not reaching into the space in front of Bill, Judy helps to make mealtime _____ for Bill.

pleasant

49. Another way to help make mealtime pleasant is to keep your arms close by your sides.
Judy helps to make mealtime pleasant by keeping her arms _____ by her sides.

close

50. When you keep your arms close by your sides, you do not wave them around into the space in front of persons sitting beside you.
Judy keeps her arms by her sides and does not _____ them around.

wave or reach

51. When you keep your arms by your sides, you also do not raise them over your head to stretch.
Judy has her arms near her sides. She does not put them over her head to _____. stretch

52. We have found out that at the table a person puts his arms only into the space in _____ of him. front

53. Let us see how Mother puts food into her mouth and how she talks at the table. (no response)

54. Mother will do what is right. Therefore, each person will be right if he does what _____ does. Mother

55. We know that everyone at the table will do what Mother does because Mother is " _____ " of the table. boss

56. Only a small amount of food should be put into your mouth at one time.
Mother puts food into her mouth in _____ amounts. small

57. Mother does not stuff her mouth full of food. She has only small amounts in it at one time.
When Mother's mouth has food in it, her mouth is not s _ _ _ _ ed full of food. s t u f f ed

58. When a person chews food, he keeps his mouth closed.
Mother has food in her mouth and is chewing. She has her mouth _____. closed

59. Mother's mouth is not open when she has food in it. Her mouth is closed.
When food is in her mouth, Mother has her mouth _____. closed

60. When food is in your mouth, you do not talk.
Mother has food in her mouth. She is quiet and does not _____. talk

61. A person talks only when his mouth is empty of food.
When Mother talks, we know that her mouth is _____, with no food in it. empty

62. What does Mother do if she has food in her mouth when someone asks her a question? (no response)

63. A person waits until his mouth is empty to talk.
Mother has food in her mouth. She will _____ to talk. wait

64. Mother needs to let the person know that she is waiting to talk when her mouth is empty.
Mother is not going to talk until her mouth has no food in it. She wants to let the person _____ why she is waiting to talk. know

65. Mother makes a motion with her finger to show the person that she cannot talk.
The person will know that Mother is waiting to talk if Mother makes a motion with her _____. finger

66. Since Mother does not talk with food in her mouth, she waits until her mouth is empty to talk. To let someone know why she is waiting to talk, Mother makes a motion with her _____. finger

67. Mother answers the person when her mouth is _____. empty

68. Let's listen to hear how Mother talks at the table. (no response)

69. A soft voice can be used when you talk to other persons at the table.
Mother talks to Bill and Judy with a _____ voice. soft

70. Everyone is near enough to hear what is said when a person talks softly at the table.
Mother can talk in a soft voice and know that Father, Bill, and Judy are _____ enough to hear her. near

71. Since everyone is near enough to hear when any person talks softly, no one has to shout.
Mother knows that everyone can hear her when she talks softly. Therefore, she does not need to _____. shout

72. Eating at the table is more pleasant when each person speaks in a soft voice.
Mother, Father, Bill, and Judy all use a soft voice when they speak. Eating is more _____ for them. — pleasant

73. We know that no one needs to use a loud voice at the table to let everyone hear. A loud voice also makes eating at the table unpleasant.
If Bill talks in a loud voice at the table, eating is _____. — unpleasant

74. To make eating more pleasant, each person at the table should talk with a _____ voice. — soft

75. Let's look to see what Mother does with her hands while she is at the table. — (no response)

76. If we watch Mother and do what she does, we will do what is right because Mother is " _____ " at the table. — boss

77. Most of the time right-handed people hold the fork in the right hand.
Mother is right handed. She has her fork in her _____ hand. — right

78. When the fork is in the right hand, the left hand is usually in the lap.
In her right hand Mother is holding her fork. Usually she keeps her _____ hand in her lap. — left

79. Sometimes the left hand is taken out of the lap. When a bite of meat is cut, the left hand is taken out of the lap.
Mother is going to cut a bite of meat. She takes her left hand _____ of her lap. — out

80. Before cutting a bite of meat, the fork is put into the left hand.
Mother takes her fork from her right hand and puts it into her _____ hand. — left

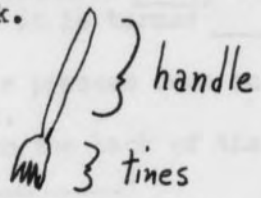
81. The right hand is empty. Then the knife is picked up with the right hand.
Mother now has the _____ in her right hand. — knife

82. When you are ready to cut the meat, the fork is in the left hand and the knife is in the right hand.
In her left hand Mother has the _____. In her right hand she has the _____.

fork, knife

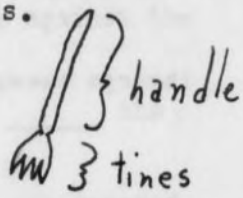
83. Mother has the handle of the fork in her left hand. The tines of the fork are on the other end of the handle.
On the other end of the handle are the t_n_s of the fork.

tines



84. The thin sticks on the end of the fork handle are the t _ _ _ s.

t_ _ _s

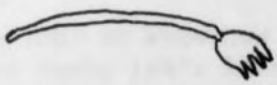


85. When a person cuts meat, he uses the tines of the fork to hold the meat firmly in the plate.
The meat is held firmly in the plate with the _____ of the fork.

tines

86.

fork with tines up



fork with tines down

87. When Mother puts the tines into the meat, the tines are pointing _____.

down

88. The fork is turned over so that the back of the fork is upward.
Mother turns the back of the fork _____.

upward

89. We now know the position of the fork when Mother cuts a bite of meat. The tines of the fork are pointing _____ and the back of the fork is turned _____.

down, upward

90. Let's now find out how Mother holds the fork in her hand.

(no response)

91. The fork is in Mother's _____ hand and the back of it is turned _____.

left, upward

92. The first finger presses down on the back of the fork.
Pressing down on the back of the fork is Mother's _____ _____.

first finger

93. The thumb is placed under the fork handle and presses against the handle.
Mother's thumb presses against the fork handle and is _____ the handle.

under

94. The other fingers are wrapped around the fork handle.
Wrapped around the fork are Mother's _____ _____.

other fingers

95. Mother holds the fork in her left hand with her _____ _____ pressing down on the back of the fork.

first finger

96. Mother's thumb is _____ the handle of the fork

under or against

97. Mother has wrapped her _____ _____ around the fork handle.

other fingers

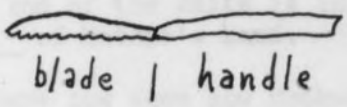
98. Now that we know how Mother holds her fork, let's look to see what she does with her knife when she cuts meat.

(no response)

99. Mother has the handle of the knife in her hand. The sharp edge of the knife points down to the plate.
Pointing down to the plate is the _____ edge of the knife.

sharp

100.



The knife has two parts, the handle and the _____. blade

101.

The first finger is on the top edge of the handle, near where the _____ starts. blade

102.

Placed along the side of the handle is the _____. thumb

103. The other fingers are curled around and under the handle.
Mother has her other fingers curled _____ and _____ the handle. around, under

104. With the first finger, the thumb, and the other fingers in place, the end of the handle pushes into the middle of the hand.
When Mother holds her knife to cut meat, the end of the handle is in the _____ of her hand. middle

105. When Mother has her knife ready to cut meat, the first finger is on the _____ edge of the handle. top

106. Mother has her thumb placed along the _____ of the handle. side

107. Curled around and under the handle are Mother's _____ _____.	other fingers
108. The end of the knife is in the _____ of Mother's hand.	middle
109. We have now seen how Mother holds the fork in her _____ hand and how she holds the knife in her _____ hand.	left, right
110. Mother has her fork and knife ready to cut meat.	(no response)

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