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ABSTRACT

This is a report of a Conference of State Supervisors of Mathematics held at the University of Virginia December 4-9, 1969. The long-range goal of the conference was "to stimulate replication of successful compensatory programs in mathematics for low achieving students." Forty-eight state supervisors representing 34 states and Puerto Rico participated. This report contains the purposes and procedures of the conference, the two papers presented, a brief description of the approach to training teachers of low achievers which was demonstrated at the conference, and a summary and analysis of each of the five model compensatory programs which were presented at the conference. (FL)

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PROGRAMS IN MATHEMATICS FOR LOW ACHIEVERS

REPORT

NATIONAL CONFERENCE OF STATE SUPERVISORS OF MATHEMATICS

UNIVERSITY OF VIRGINIA
CHARLOTTESVILLE, VIRGINIA

DECEMBER 4 - 9, 1969

SUPPORTED BY

THE UNIVERSITY OF VIRGINIA
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PART I

PURPOSES AND PROCEDURES OF THE CONFERENCE

A Conference of State Supervisors of Mathematics on Programs in Mathematics for Low Achievers was held at the University of Virginia December 4-9, 1969. The conference was supported by the National Science Foundation and the United States Office of Education. All states in which there was at least one identifiable state supervisor of mathematics, the District of Columbia, and Puerto Rico, were invited to send at least one representative to the conference. The more populous states and possessions were invited to send more than one. The June, 1969 "State Specialists in Mathematics" list developed by the Association of State Supervisors of Mathematics was used as the invitation list.

Forty-eight state supervisors representing 34 states and Puerto Rico participated. In addition, four representatives from the National Science Foundation and three from the U. S. Office of Education participated in all or parts of the conference activities. (See Appendix A for a list of conference participants.) Sixteen additional persons attended one or more of the sessions as observers.

The long-range goal of the conference was to stimulate replication of successful compensatory programs in mathematics for low achieving students.

State supervisors of mathematics as a group are in a unique position to influence mathematics programs throughout the United States. These people fill leadership positions. They are often consulted to suggest ways to improve student learning and to help design special programs for low achievers in mathematics. The conference was planned for these people. It was believed that it would be largely through their efforts that the long-range goal of the conference would be attained.

The term "low achiever" was left undefined, but the following definitions were adopted for the conference.

(1) Underachiever - a student whose achievement is more than one-half of a standard deviation below expectations based on ability measures. This includes, but is not limited to, lack of achievement caused by economic or cultural conditions.

(2) Compensatory program - an instructional program designed to ameliorate underachievement as defined above.

With the long-range goal and these definitions in mind, the conference planning committee of the Association of State Supervisors of Mathematics provided for three basic activities in connection with the conference. (See Appendix B for a copy of the conference program.)

(1) A survey was made to compile a state-by-state listing of programs and people. Each state department was requested to complete a questionnaire about the state on which was to be listed model compensatory programs and resource people. (See Appendix C for a copy of the questionnaire.) The results of this survey may be found in Appendix D (Model Compensatory Programs), and Appendix E (Resource Personnel).

(2) As background information for the participants, three invited presentations were planned for the conference program. The first of these was concerned with certain sociological factors often associated with low achievement in school, particularly economic and cultural disadvantage. The second presentation dealt with performance objectives for low achieving students. The third was concerned with the training of teachers to work with these students. The first two of the above mentioned presentations were made from prepared papers. A copy of each of these papers is contained in Part II of this report. The third presentation was a demonstration of the Madison Project approach to training teachers to work with low-achieving students. A brief description of this approach is contained in Part II, also.

(3) A knowledgable person from each of five representative compensatory programs was invited to speak to the conference on the program he was connected with. This person in each case was asked to prepare a written summary of his program and to provide examples of materials, evaluation reports, etc. which would enlighten the conference parti-

cipants about that program. In his written summary and during his presentation, the program representative was asked to address himself to the following six questions.

(a) What are the objectives of the program?

(b) What is the student audience toward which the program is directed?

(c) What are the characteristics of the school, school district, or area in which the program is being operated?

(d) What procedures were used in implementing the program? Included should be administrative, cost, and teacher in-service considerations.

(e) What evaluation has been conducted and what are its results?

(f) What recommendations would you make to a school system that wished to install a similar program?

Participants were asked to seek answers to these six questions in the written summary of each program and during the verbal presentation and its associated questions and discussion session.

After each presentation, question, and discussion session, the participants were divided into four small groups. During the small group session, the participants analyzed the program just presented, with the object to isolate those features which appeared to be essential to the success of the program; that is, those features for which it appeared to be necessary to make provision if a school were to attempt to replicate the program and have some hope of attaining success with it. The basic components considered for each program during the small group sessions were as follows:

(a) Personnel (teachers, paraprofessional personnel, etc.).

(b) Materials (specially prepared for student or teacher use).

(c) Student Activities.

(d) Planning and Evaluation.

(e) Administration.

(f) Other.

The written summaries of each of the five programs as prepared by the presenters, the summaries of the written reports from the small group sessions, and the conclusions drawn from these regarding principles that are critical to the success of compensatory mathematics programs constitute Part III of this report.

PART II

INVITED PRESENTATIONS

This part of the report contains the two papers presented at the conference, and a brief description of the approach to training teachers of low achievers which was demonstrated at the conference. Florence Z. Segal, in her paper, is concerned with certain sociological factors often associated with low achievement in school. In the second paper, Vincent Brant discusses an action approach to using behavioral objectives in classes of low achievers. The final section of Part II is a brief description by Alan Barson of the Madison Project approach to training teachers to work with low achievers.

LOW INCOME BACKGROUND AND ACHIEVEMENT IN SCHOOL - ARE THESE INCOMPATIBLE?

Florence Z. Segal, Assistant Professor
School of Social Work, Virginia Commonwealth University

I am delighted to be here in Charlottesville to talk with a group of educators about a question with which I have been passionately concerned for some time - the question of the relationship of children from low income backgrounds and our educational system. I too am an educator, but also a social worker and as a social worker I have had the experience of working in a public school system where my major responsibility was to design programs to better enhance the learning environment for "disadvantaged children". Mr. Phelps last night pointed out the need to distinguish semantically between those low achievers with low IQ's, those who don't take tests well, those of low income backgrounds, those disadvantaged.

Perhaps at this point we had better become semantically compatible and work through all the possible synonyms for "children of low income background". We will be addressing ourselves to those children from homes that are classified as being in poverty, but will also, I am sure, find ourselves using the euphemisms "disadvantaged, deprived, culturally different". When I talk with a group about disadvantaged children I always remember the wonderful Jules Feiffer cartoon where in a series of pictures a rather bedraggled looking old man is involved in a monologue where he says "I used to think I was poor, then they told me I wasn't poor I was needy. Then they told me it was self-defeating to think of myself as needy, I was deprived. Then they told me deprived was a bad image, I was underprivileged. Then they told me underprivileged was overused, I was disadvantaged. I still don't have a dime, but I have a great vocabulary."

Well if we have gotten that out of the way, let us begin to think about poverty stricken children. What they are like, how they react and learn and what in or missing from their lives create handicaps for them in the school situation. Dean Cyphert said that we must focus on manipulatable variables and we will, however, discuss those variables which may be manipulatable. In the 1960's there

have been hundreds of studies of their home environment, language development, psycho-educational appraisal, learning disabilities and remediation and compensatory education projects. Large numbers of books and articles and educational, psychological and sociological journals have provided teachers with information about children who come to school from slums or otherwise depressed neighborhoods or families. Public school systems have sought to respond to increasing public concern about educational accomplishments of children from low income families, by analyzing the complex of factors that might lead to underachievement in school. These factors include the content and form of the curriculum, the structure and style of classroom teaching, the physical and emotional problems of some children, the demoralizing economic and social conditions of some homes and, most importantly, a gap between school and home often so wide as to leave them at cross purposes. It is because of the awareness of this gap that I am delighted as a social worker to be able to be here to speak to you as educators, in the public school system. If this gap between home and school is as wide as is generally accepted what can we as members of compatible disciplines do to close this gap? What can we, as members of compatible disciplines do to make possible low income background and achievement in school?

In 1960 the Ford Foundation made a grant to some seven schools in the United States to support a demonstration project that was given the name "Great City School Improvement Project." The central thrust of the program was the belief that the school and its immediate community should be brought closer together. If we accept the statement of that great educator Horace Mann that "Education beyond all other devices of human origin is the great equalizer of the conditions of men - the balance wheel of the social machinery", then we must accept the fact that the education system must be intermeshed with the theory and research from the social sciences and from professional groups concerned with studying urban life. From the sociological viewpoint, the Great City School Improvement

Project was attempting to change the relationship between bureaucratic organizations - the school - on the one hand and external primary groups - families and neighborhoods - on the other hand. The implicit sociological theory underlying this approach is that maximum goal achievement in contemporary society occurs when bureaucratic organizations and families are intertwined.[1] Educators holding this view argue that motivation is central in educating the child and the best way to motivate him is by relating the teaching situation to his ongoing life experiences which are always partially unique because dependent on his particular family situation. Many recent experimental approaches to educating "culturally deprived" children have assumed this position. It is often implicit in the idea of the "community school" advocated by many educators. It is important to recognize that some schools are seeking closer contact with families precisely because they want to increase the efficiency of education.

Education as a system in society has taken on as one of its primary roles the responsibility of socialization of the child. The school assumes direct responsibility for the introduction of the young to the established and cherished modes of life and thought of the community. The function of the school is to provide a selected environment and schedule of activities for the nurture of the young in those appreciations, outlooks and behaviors considered most important and essential to the life of the group. The enterprise of education is grounded in two basic and inter-related faiths; faith in the modifiability of the human form and faith in the possibility of controlling the human enterprise in the interest of cherished ends or values.[2] If we assume that people by nature are capable of moving toward becoming self-directing, self-reliable, responsible and consistent members of society, it is feasible that man can reach new levels of creativity, inventiveness, skill and socialization. Values, attitudes, concepts, emerge from three factors in the development of the individual; 1) the unique nature of the individuality of the human being, 2) the totality of his experiences

and 3) his immediate situation. James Coleman in his epic study of "Equality of Educational Opportunity" found that a sense of control of one's own destiny was by far the best predictor of performance in school. Perhaps it is time now for us to look at the predictors of performance or of non-performance in the lives of low income children.

There are those who say that disadvantaged children come to school under certain handicaps because of the disparity of values held by their families and by the educational system. It is now understood that children come to school with vast amounts of information accumulated both consciously and pre-consciously and that the parallel impact of family, community and society continues to supplement, complement and sometimes interfere with formal school learning. Adelaide Jablonsky in talking about relevance in education says that the term "relevance" implies that what is to be learned is perceived by the learner as having meaning in his present life and the expectation that it will have utility in future learning or coping situations.[3] Let us look at what has meaning in the life of the poor child who is beginning a school experience.

We must attempt to understand the poor and yet the more we struggle to deepen our understanding the more we seem to end up in a morass of stereotypes and clichés. Elizabeth Herzog of the United States Department of Health, Education and Welfare, warns against what she describes as the "cookie cutter concept of culture", that is, the assumption that a culture molds all its members by identical forces so that they turn out like cookies all produced by the same form.[4] Perhaps the best way to destroy a stereotype is to test it against the reality of the uniqueness of the individual while keeping in mind the cautions against the "cookie cutter concept" of poverty. However, let us for expediency and economy discuss those generalized aspects of poverty that might well interfere with achievement in school. Poverty involves underemployment and scattered irregular miscellaneous employment often at undesirable occupations; it involves extensive borrowing

through formal and informal sources, use of secondhand clothing and furniture and overcrowded dwellings and lack of privacy. The poor have a higher death rate, a lower life expectancy, lower levels of health - physical and mental - and of nutrition than the prosperous; they depend more on home remedies and folk medicine since medical care is expensive and frightening; they are relatively unlikely to be members of labor unions, political parties and other organizations; they are more inclined to excessive drinking and to violence than the prosperous.

The result of these circumstances is a set of life conditions which consist of the following general limitations:[5]

1. Comparative simplification of the experienced world
2. Powerlessness
3. Deprivation
4. Insecurity

The poor, of all strata in society, have the least opportunity to experience varieties of social and cultural settings. They are caught in a trap with a very narrow range of situations and demands. Socially they seldom go beyond the borders of kinship and neighborhood groups, people very like themselves. The poor also are constantly imbued with, controlled by and engulfed in impotence. Because they are unskilled and uneducated their jobs are most expendable. They are the most easily replaced workers in our society. On the job itself the very poor man can exercise little autonomy and has small opportunity to influence conditions of work. To talk about the poor being limited by deprivation sounds almost redundant, but in this country there is a special kind of deprivation that poor people have. If poverty is looked at as a lack of resources relative to felt wants and needs, then America probably has the greatest gap between accepted goals and aspirations and the extent to which the lower class can realistically expect to attain them. Sociologists talk about poverty in

India and China as being more objectively devastating than poverty in the United States, but in the United States with the instant communication resulting from our mass media the poor man is more aware of and more affected by his deprivation. Constant awareness of low status and the failure which it rightly or wrongly implies understandably leads to a diminished and damaged self-concept. Finally the poor lives constantly with the feeling of insecurity. Poor people are more at the mercy of life's vicissitudes than are the more affluent. All the hazardous possibilities of sickness, injury, loss of work, legal problems may overwhelm anyone, but to the poor man these problems are not only overwhelming but may be totally destroying. He cannot successfully navigate the channels involving using public sources of emergency help, he is more likely to lose his job on short notice and an emergency expenditure of funds which had been unanticipated may mean the postponement of rent payments and inevitable eviction. So then, the poor have great feelings of alienation from society - feelings of powerlessness, meaninglessness, anomie and isolation.

Let us now look at this feeling of isolation, of powerlessness, of apathy within the poor family and how this might well affect the child beginning school. Lola M. Irelan of the Federal Welfare Administration, speaking of the values of the poor said "Essentially they seek and value the same things as other Americans".[6] So then why do we hear that children from low income backgrounds have different values then the values embraced by the school system? Perhaps we must look at the relationship of experience to learning. It is profoundly difficult even to concieve of something that is in no way related to ones own experience. With respect to learning about values, it has been stated that "If men are going to negotiate their disagreements over values rationally, they have to appeal to evidence that is equally available to all".[7] Because of the inter-relationship between a person's experience and what he learns to value, a "lesser" good, (experienced and at least directly known for what it is), may well supplant a

"greater" good not similarly known at first hand. Thus a person's own knowledge and experience including what he thinks the future holds for him directly affects his conceptions of value and good. Although the very poor ascribe at least an aspiration to the middle class value of having a good education, having homes of their own and the material comforts of society, they have very little knowledge as to how such aspirations may be fulfilled. The tension between the pull of societal values and their unattainability could hardly have been better created if done so purposely. Societies that take pride in how effectively their cultures inculcate values, but are concerned about the erratic way in which the goodies of life become available face an additional problem. The problem of transposition of values is obvious when we observe descriptions of a number of sub-cultures, of street corner society and of delinquency. However effective a culture may be in teaching acceptance of a society's values, if the society is erratic in providing access to these values it invites the thwarted to develop escape routes. Ben Bagdikian in describing the values of the poor says that middle class assumptions of common sense and social responsibility often make no sense to the poor. "What is prudent for the well fed may be irresponsible for the poor. For the poor the future is demonstrably treacherous, self-denial brings them not the reward of evenly distributed joy, but the punishment of permanent loss."[8] This was stated even more specifically by another observer who said "What strikes observers of the poor as the rejection of middle class standards reflects their sense that if the world in which they are living have done so poorly by them, it can not reasonably be expected to do better".[9] So then, we come again to the relationship of aspirations and values and, in turn, to achievement. Although school-approved values may be accepted by the poor, because of lack of experience with success of achieving these end values, the motivation is not available to try to achieve. Just as the very act of aspiring appears to be related to ones experience and to the social support given to it, so also do

the changing levels of man's aspirations appear to be related to experience. "Nothing succeeds like success" - although a cliche, has many implications for achievement in school. The capacity of one achievement to whet the appetite for another cannot be underevaluated.

What possibilities are there for achievement for the child of low income background? The disadvantaged child beginning school has little preparation either for recognizing the importance of schooling in his own life or for being able to cope with the kinds of verbal and abstract behavior which the school will demand of him. Although he generally comes to school clean and neat and having been told by his mother to be a good boy, he lacks the ability and the experience to carry out those tasks which would make him appear good in the eyes of his teacher. Miller and Swanson in their study of expressive styles of behavior of children said that a child tends to develop a conceptual style when child-rearing practices favor psychological discipline, symbolic reward and maternal self-control (the pattern most often associated with middle class families).[10] However, when discipline was physical, the reward tangible and maternal self-control limited (more typical of lower class homes), the child more often developed a motoric style. These findings were supported by another researcher[11] who finds significant social class differences in pupils' selection of abstract as opposed to concrete explanations and definitions. Martion Deutsch emphasizes the differences between the motoric style of learning and the conceptual style. His thesis is that the lower class child enters the school situation so poorly prepared to produce what the school demands that initial failures are almost inevitable and the school experience becomes negatively rather than positively re-enforced. Thus, the child's experience in school does nothing to counteract the invidious influences to which he is exposed in his slum and sometimes segregated neighborhood.[12] The child from the poor home has what has become known as "stimulus deprivation". Jean Piaget describes the rate of development of the

child as being affected by environmental circumstances. Thus, the greater the variety of situations to which the child must accommodate his behavioral structures the more immobile they become. Thus, the more new things a child has seen and the more he has heard, the more things he is interested in seeing and hearing. Moreover the more variation in reality with which he has coped, the greater is his capacity for coping. If we accept the hypothesis that stimuli deprivation would have a negative affect on the ability of the child to develop a conceptual style, a style that is necessary in order to cope with the type of education he is given upon entering school, we must now look at the range of stimuli of the poor child. There are usually few if any pictures on the walls, the objects in the house are not marked by a great deal of color variation, toys to stimulate skills in categorizing or in conceptualizing about objects are not available and most important, the lower class home is not a verbally oriented environment. It is generally agreed that language plays an important role at all levels of learning. Language development involves the correct labeling of the environment and the use of appropriate words for relating and for categorizing. Certainly language is one of the areas which is most sensitive to the marginal circumstances of the lower class life. The paucity of experiences in thinking in abstract terms, of getting practice in discrimination or feedback from adults correcting the child's enunciation, grammar or pronunciation and the general high noise level encountered in poor environments all contribute to the child's lack of preparation for an early school experience.

This early school experience is one that is fraught with difficulties for children of all economic backgrounds, but particularly fraught with difficulties for the child with low income background. The child's separation from his mother on the day he leaves for school is one of the major crises of his life. He must manage on the personality integration he has achieved during the years of sociali-

zation within the family and on the security he feels awaits him at home, which will still remain the center of his life. He enters the classroom and feels somewhat lost among so many strange children, uneasy over the unfamiliar procedures and uncertain as he seeks to follow the directions given by a strange woman. Within his family the child's position was determined largely by biological determinants: he was a member of the childhood generation of a given sex, age and sequential position. Basically he was loved or accepted because he was his parent's child, as part of a group of children of the same age he is often treated as part of the collectivity rather than with the individualized attention to which he became accustomed at home. He must forego many of his desires and mask his idiosyncrasies in order to fit into the group. In finding his place in a society of peers and by being evaluated by adults, his teacher, by schoolmates and playmates, the child develops a more adequate evaluation of himself than when he is relating primarily to family members. He forms his self-concept that serves to regulate his ambitions and ways of relating to others. The child realizes that some hold him in esteem and seek him as a friend, as a member of a team, as a birthday guest. He recognizes that teachers praise his work, give him responsibilities or consider him a dull boy or non-entity. He is learning who he is and he is simultaneously learning his society's value system. This shift to being evaluated through achievement rather than through ascription is fundamental to have the child learn who he is and what he can expect of himself.[13]

The child from the deprived home has certain serious burdens to bear when he starts school. The teachers are assessing and rewarding the child for cognitive abilities and for "citizenship", reliability and meeting obligations and commitments as well as class conduct. Despite the efforts to evaluate and reward children on an equal basis, teachers are human and usually become more involved with the intelligent, knowledgeable, better mannered, more punctual

children. The teacher's interest in a child and her expectations for higher performance levels appear to stimulate the development of intelligence as well as to improve learning. Also the school system favors children who have been prepared in the home to be verbal, curious, motivated to learn and to control distracting impluses. A child who comes from a home where there are many distracting advents' much noise, little opportunity for discussion with an adult is ill prepared for a new pattern of relating that he will encounter in school. The underprivileged child may be perplexed by the value system he encounters. His parents do not provide models of intellectual achievement with whom to identify and, unless the school serves a very homogeneous community, the child now must come to grips with status problems based on social class and ethnic backgrounds. The attitudes towards the underprivileged child and towards his family enter into his self-concept, into his evaluation of his parent's models, and enter the kind of aspirations that he can hold that he feels have a possibility of achievement.

The fact that schools expect a certain type of time orientation from children, is another deterrent to the adjustment of the child in school. Mr. Phelps talked of the fact that time orientation of teachers is frequently different from students - that perhaps there is too much emphasis on learning certain content within a specific amount of time. It has been pointed out by anthropologists that time concepts differ from culture to culture and that time as a governor of life is a relatively modern phenomenon and is one found mainly in the middle class. The middle class teacher organizes the day by allowing a certain amount of time for each activity. Time is an essential feature in the measurement of the children's performance by testing and in the adjustment of children to the organizational demands of the school. The fact that there is a tendency for children from low income families to be proportionally more present oriented then future oriented, interferes with their planning in the use of time. It is rather difficult to think of time in terms of future planning when one is

faced with the daily exigencies and demands of life. A low income family belongs to a socio-economic group that is considered unable or unwilling to plan to act in the future, to defer present gratifications for the sake of future reward. The point is not ability or inability to plan for the future and act in a way to realize these plans, but rather the present or absence of a clearly perceived probability that deferred gratification will pay off. Thus, although one might find less frequency of future oriented planning among the poor than among the non-poor, it might still not be possible to conclude that future orientation is non-existent or that it is repudiated as behavior or as a value. The danger of over-simplification in talking about values within the lower socio-economic classes, ignores the fact that most of us belongs to a number of sub-cultures representing social class, ethnic background, occupational groups, peer groups, religious affiliations, family etc. At different moments we cleave to the values of different groups, depending on circumstances and our own unique socio-economic and genetic history. Which values wins out at the given moment depends upon the inter-action of a great many factors. It is in this connection that we must be aware and beware of the "cookie cutter concept" of culture.

Another area in which the lower class child lacks pre-school orientation is the internalized expectation of reward for performance or for the successful completion of a task. Because of the paucity of adult-child interaction in poor homes task assignments tend to be motoric in character, have a short time span and be more likely related to very concrete objects or services for people. The child does not have the preparation for the kind of tasks that involve language and conceptual processes.

The child from the low income family also has not had the experience of having been able to question and to have had responses that will aid him to formulate some concepts of the world, an essential step in education. An English sociologist has pointed out[14] that the lower class tends to use informal lan-

guage and mainly to convey concrete needs and immediate consequences, while the middle class usage tends to be more formal and to emphasize the relating of concepts. We have said that language is the essential ingredient in concept formation and problem solving and in the relating to and interpretation of the environment, and the low income child with the language handicap has special disadvantages at the point of entry into the formal learning process.

We have talked briefly about the fact that the child's self-concept when he begins school comes from his evaluation of people's responses to him. It is necessary to explore this idea a little further when we discuss the child's achievement in school.

The causes of underachievement regardless of social class are manifold and not always easy to uncover. Lack of ambition may be the problem for it does accompany the hopelessness generated by discrimination in employment and housing. Many teachers describe low income children as dirty, disorganized, suspicious, hostile. These descriptions are probably apt because many disadvantaged children come to have negative feelings about themselves. If a child from a poor family feels powerless and isolated how much more powerless and isolated must a poor black child feel, or in other parts of this country a poor Indian child or a poor Mexican child? Many disadvantaged non-white children believe they are bound to fail. Therefore, many do. They are influenced by the teacher's expectation that they will learn slowly or not at all. When teaching is geared to low expectation of success, many children who have ability become bored, disgusted, apathetic, make no effort and withdraw psychologically or even physically, all of which verifies the teacher's pre-judgement of them. This has been dramatically illustrated in recent books like Herbert Kohl's Thirty-Six Children, Jonathan Kozol's Death at an Early Age, and Nat Hentoff's Children Are Dying. The teacher's admonition to a child, "You cannot do" and the child's response, "I can't," becomes a self-perpetuating process of prophecy

fulfillment. Failure does not provide motivation for learning nor does it release energy for learning. Non-white children who are poor have special problems in school because of, what actor Ossie Davis recently described as the "racist aspect of the English language".[15] Color words have value overtones. Children learn to associate the words black and brown with unpleasantness, evil, danger and inferiority. Non-white children may internalize these values and develop feelings of inferiority, guilt and shame. As a result, they come to hate themselves, their self-concept is diminished, they feel they will not be given a chance, they feel they will not achieve and eventually they stop trying. Whereas in middle class families parents ask 'What do you want to be when you grow up?", in low income families this question is frequently both insulting and inappropriate. The choices available to the poor child and particularly to the non-white poor child, are minimal. Children in poor families may become more cooperative, but they must learn to stand up for themselves and to fight when necessary. They have few personal belongings so they learn to take what they need or want from whatever is available. There are few things available that one wishes to hurry for. Reliability and hard work are not required so they are not accorded particular value. The future holds no hope for change, no one asks the child what he wants to become, so aspirations remain at a low level. Because no one expects the child to become anything different, he expects little or nothing for himself or from life. Because he has no hope for future achievement or for eventual security, he sees no reason for patterns of behavior directed towards the future. A teacher who does not understand this may misjudge a child's inability to forego immediate satisfactions in favor of future goals. A simple example of this is the child who eats whatever he may have whenever he wants to. He devours lunch as soon as he arrives in class with never a thought about what he will do when lunch time comes.

Another factor making for under-achievement in school certainly stems from

the strong tendency in our society to motivate academic achievement by holding out the promise of future occupational rewards. It has been pointed out however, most clearly, that educational attainment does not necessarily enable the lower class person to overcome the disadvantages of his low social origin. The influence of social class as a deterrent to social mobility despite the possession of education becomes all the more important when coupled with influences stemming from race and nationality. The point is, of course, that the major inducement to educational achievement in our society is the promise of future occupational rewards. If however, it is known in advance that these rewards will be largely withheld from certain socio-economic and racial groups then it is unlikely that high levels of educational achievement can be sustained in such groups. Thus, academic performance may be devalued because the young in such groups see no relationship between it and the reality of their future. The child who comes to a system of education that places a strong stress upon doing rather than being, upon a future orientation rather than an orientation toward the present or the past, upon the notion that man is able to control his own destiny and that he is flexible and capable of change, must try to adjust his particular value orientations from his home and community to these new sets of values.

The picture that has been painted is a very depressing one and perhaps implies to you Deutsch's[16] thesis of inevitability of non-achievement in school for disadvantaged children. Terrence Johnson in a poem entitled "Requiem for a Failure"[17] pointedly states this thesis of inevitability of non-achievement, when he says;

> "I view solemly the cracked walls.
> They stand cold...lifeless.
> I view garbage overflowing in the streets.
> It's filthy...lifeless.
> Then I see my child.
>
> He lives between these roach infested walls.
> He plays in these filthy streets.
> He is full of life, by no means lifeless.

My son brings these crevice-streaked walls,
These filth-lined streets to life with just his presence.
They seem to laugh at me, reflecting, reflecting,
Reflecting greater than any mirror, my failure.

My son cannot envision his future.
Only I see his destiny.
It hurts to see such a glum picture.

Do we accept the inevitability of failure for disadvantaged children. Do we believe that instrinsic in a low income background are the conditions that will lead to non-achievement in school? Do we accept the fact that the child of low income background will be weeded out from the school system because he cannot make it?

Jerome Bruner in talking about tested achievements in the schools describes our system as a meritocracy. A meritocracy, he said, implies a system of competition in which students are moved ahead and given further opportunities on the basis of their achievement with position in later life increasingly and irreversibly determined by earlier school records. The late bloomer, the early rebel, the child from an educationally indifferent home, all of them in a full scale meritocracy become victims of an often senseless, irreversibility of decision. John Holt an exceptionally outspoken and articulate teacher wrote in "How Children Fail" that 'We adults destroy most of the intellectual and creative capacity of children by the things we do to them or make them do. We destroy this capacity above all by making them afraid, afraid of not doing what other people want, of not pleasing, of making mistakes, of failing, of being wrong. Thus, we make them afraid to gamble, afraid to experiment, afraid to try the difficult and the unknown". Holt is talking about children from all social classes when he describes the destruction of children's enthusiasm to learn. How much more destruction is involved when a child from low income background comes to school tentatively trying to absorb a new set of values, a new style of learning, a new group of relationships and must face the destruction of any enthusiasm he might have brought with him to school?

And so we come to our original question, "Low income and achievement in school - are these incompatible?" I say strongly that they are not, that we must recognize the hazards, the burdens, the difficulties that low income children have when they come to our schools, but that we must not put the total responsibility for non-achievement upon the student.

Education has now found itself at a cross road in its development and in taking time to examine critically the direction in which it is moving and to assess the need for change. For the most part, this has occured in response to forces outside the profession. Not that education can act independently of social forces, but the question really is whether education as a social system will respond to and interact with social forces in a way that is comensurate with its knowledge, skill and commitment to human values. Education is at such a cross road and the choice is between progress and retrogression.

When I was invited to Charlottesville to talk with you, I realized that I could give a popular speech by affirming the hard lot of the school teacher in relation to children of disadvantaged background. I could tell you, and it would be true, that overwhelming demands, impossible demands are made on those who are responsible for education of children from backgrounds which do not prepare them for the educational system as it now exists. I could tell you that teachers in middle class schools are expected to have expertise in only their own area of knowledge, but that teachers in low income schools are expected to be knowledgeable not only about education but also to have particular expertise in social problems and the methods of intervention pertinent to produce changes in the educability of low income children. I could tell you and it would be true that teachers in slum schools have been the most attacked and that they have the lowest status within the hierarchal organization of the education profession. In short, I could state that these teachers are overworked and underloved and having said that we could all be complacent and continue to rationalize our doing business in the old way.

How effectively have teachers made clear the limitations of the education system? How effectively have teachers spoken out about the consequences of the failures of the system? The fact is that while undoubtedly the system in some ways fulfills its function of transmission of culture, supporting the discovery of new knowledge, providing socialization, and transmitting the values and attitudes of culture, the system has not achieved its objectives of providing equal opportunity for education for all people. This equal opportunity cannot exist for a child of low income background who is forced to abandon values that have been relevant to his style of life, who is forced to abandon language that was relevant to his style of life and to be thrust into a new style of learning and reacting for which he is not prepared. Certainly there is no suggestion that the education system be scrapped overnight, but to what extent have teachers spoken out publicly and continuously and made nuisances of themselves in pointing out limitations and what has to be done? At the same time improvements might have been urged in the existing system while opening discussion about possible new systems and possible new approaches. I guess what I am saying or what I am trying to say is that teachers must take on an advocate role - as social workers have been increasingly taking on an advocate role. Teachers must become advocates for those children of low income backgrounds who have such a burden put on them in order to achieve in a school which is not "relevant" to their life experiences or to their expectations for the future.

You may think that I am unfairly indicting the education system and I do not want to give this impression to you. The education system is merely one of the social systems within our community and the social system which perhaps most dramatically illustrates the fact that our society as it is now functioning is not an adequate problem-solving mechanism. The machinery of the society is not working in a fashion that will permit us to solve any of our problems effectively. Each of us, as a reformer, comes to our tasks with a little bundle of desired

changes. I think that we should focus now on some of the desired changes in the education system in order to provide a better nuturing ground for children of low income background. Of course the implication is that when appropriate reforms are carried through and defects corrected the system will be wholely satisfactory and the work of the reformer will be done. This is the primitive way of viewing social change. The true task is to devise a system capable of continuous change, renewal and responsiveness. John Gardner[18] said that a society capable of continuous renewal will be one that develops to the fullest its human resources that removes obstacles to individual fulfillment, that emphasizes education, lifelong learning and self-discovery. We are still far from having created such a system.

In this connection James B. Conant has concluded after studying schools in the ten largest cities in the nation, that to a considerable degree what a school should do and can do is determined by the status and ambition of the families being served. He has pointed out the deleterious effects on motivation and academic achievement resulting from a culturally impoverished home life.

There are many theorists who believe that it will not be enough to merely improve teaching methods and curricula, to devise motor oriented methods of teaching rather than conceptual methods of teaching. Many theorists think that the problem must be to improve the school as a social system. The many proponents of pre-school training in basic perceptions that has been translated more or less successfully into "Head Start" and other pre-kindergarden projects point to the necessity to prepare children for entrance into school. There are those who focus upon an orientation of teachers to the slum child's physical and social environment and its effect upon in-school behavior. Certainly the child's physical health cannot be ignored in helping him to become prepared for the new kind of experience he will have in school. Many schools are now providing breakfast for children. Experience with programs involving teacher training, breakfast pro-

grams, pre-school perceptual training, indicates that immediate and sharp improvement in attendance, behavior and school work result. However, the real question is how this immediate and sharp improvement can be re-enforced and can be maintained? When a child who upon entrance into school into a Head Start Program, shows potential and ability comparable to a middle class child and who, when tested three years later, shows a sharp drop in his achievement level, then it is time to take a serious look at what is happening within the school. Is it lack of re-enforcement, of aspirations toward learning, from the home? Is it insufficient emphasis put on continuing "compensatory" education practices in the school? Or is this drop in achievement level an inevitable concomitant of living in a slum area?

Neighborhoods which contain a predominance of residents whose cultural patterns are at variance with those predominating in the larger society present extraordinary challenges to school personnel. Children from an impoverished physical and social environment bring attitudes, expectations and motivations to the school which are often very different from and may conflict with the values which the school as a social institution is attempting to inculcate. In depressed neighborhoods culturally deprived parents often pre-occupied with their economic survival provide little if any stimulation of their children's intellectual growth. Typically these parents do not prepare their children for the school experience nor do they complement and re-enforce classroom activities. Because of this, there have been some school systems which have put much emphasis on improving and strengthening school-home relations in depressed neighborhoods. The emphasis was on assisting culturally deprived parents to develop positive attitudes toward schooling and to increase their responsibility for their children, the school program and community affairs. The School Community Coordination Program of the Richmond Public Schools, with which I was associated, had such a focus. Efforts were made to identify the factors concerning family and home life which

might adversely affect the pupil's learning and social attitudes and emotional adjustment in the school setting and to interpret these factors to school personnel. In turn, parents were encouraged to question and to learn about the types of educational programs available for their children. Parents were also encouraged to be involved in some of the planning of programs for children. After school classes were available for children and for parents, pre-school programs were designed where parents could learn the types of stimuli necessary in order to prepare their children for entrance into school. Adults were assisted to become more knowledgeable and effective citizens, parents and community leaders. This focus on increasing better relations between school and home and encouraging parents to re-enforce education as a positive motivation in their children's lives had some immediate results.

However, we cannot ignore the fact that these parents live in a society where there are still restrictions against their upward mobility, restrictions upon them because of their social class and perhaps because of their ethnic and racial background. We as teachers, as citizens, must take some responsibility to be involved in some of the social change necessary so that all members of our society have optimal chances for achievement. Yes, low income background and achievement in school are compatible, but only if we refuse to accept the "Requiem for Failure" and to work hard as individuals and in concert with other individuals and groups to bring about changes in all social systems and particularly in the education system. The low income child <u>can</u> achieve if we are willing to provide a relevant and appropriate curriculum for him and to recognize the special needs that he brings to the school situation.

FOOTNOTES

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Behavioral Objectives and the Slow Learner - An Action Approach

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INTRODUCTION

It is indeed heartening to note the increased interest throughout the country in the problem of the slow learner in mathematics. This conference of state supervisors of mathematics provides additional evidence to support this observation. Many school systems are attacking the problem using different approaches. The program for this conference includes presentations which will center around various solutions to provide meaningful mathematics instruction for students limited in mathematical ability.

You, as state supervisors of mathematics, are constantly besieged by requests of local systems in your state for assistance with educational problems. Your presence here this week indicates your deep interest in carrying back with you some ideas for action in providing mathematics programs for the slow learner.

In this report, the writer hopes to present a different approach to the problem of constructing a program for slow learners based on behavioral objectives. Baltimore County is pleased to share with you some of its ideas and experiences in setting up such a program. At the outset it should be clearly understood that we are not claiming to have uncovered a panacea or sure-fire solution. This is merely one possible approach - locally initiated and locally funded - which appears to be working well, based upon the subjective evaluation of teachers and staff as well as outside educators.

GUIDELINES FOR A SLOW LEARNER PROGRAM

The first steps in this approach included summer workshops in 1963 and 1964 which produced guidelines and recommendations for the slow learner, not only in mathematics, but for other areas as well. In particular, the characteristics and needs of the slow learner were identified. Two criteria - measurable and traits - were agreed upon as follows:

Measurable Criteria

1. I.Q. Range 75-90 from at least two group tests or an individual test.
2. Percentiles on group tests of mental ability and achievement ranging from 0-19 (approximately two or more years below grade level in reading comprehension and arithmetic).
3. Teacher grades - consistently below average.

Traits Criteria

1. Limited academic interest.
2. Difficulties in planning and carrying out work without supervision.
3. Limited creativity and intellectual curiosity.
4. Indications of short attention span.
5. Severe limitation in the ability to communicate orally or in writing.

The philosophy agreed upon by the workshop committee may be stated briefly as follows:

1. the slow learner should be educated in his own right and the maximum of his ability
2. any adaptation of an academically oriented program must surely fail
3. a program of mathematics for the slow learner should be based upon the latest developments and research in learning theory, an appropriate selection and reorganization of mathematical concepts and developing skills

4. proper pacing of the concepts and skills must underlie the structure

5. all the human resources of the educational system -- the mathematics teacher, the principal, the mathematics supervisor, resource teachers, the guidance counselor, and other specialists -- must be brought to bear on this problem.

OVERVIEW OF THE WRITING COMMITTEE - COMPOSITION, PLANS, PRODUCTS

The writing committee consisted of three elementary, six junior high school, and three senior high school teachers, a reading specialist, an artist, and the staff members of the Office of Mathematics. It is only proper at this time to give credit to the members of the supervisory staff which furnished leadership in this project. These are:

Miss Hilda Kestner, Supervisor, Elementary Division

Mr. Stanley Smith, Supervisor, Secondary Mathematics

Mr. Carey Bolster, Supervisor, Secondary Mathematics

Mr. Hugh Elliott, Specialist, Office of Mathematics

Mr. Vincent Brant, Coordinator, Office of Mathematics

The writing workshops were under the direction of Mr. Carey Bolster.

At the outset, it was decided to construct a program for these slow learners from grades 7 to 10. Although a scientifically constructed program should begin in the elementary school, it was decided to concentrate on grades 7 through 10 for two reasons. First, available research indicated difficulty in identifying the slow learner in the primary grades. Second, the problem of the slow learner seemed to be most acute at the junior high school level. It seemed wise to attack the problem where the need appeared to be the greatest.

The summer workshop in 1966 produced a resource manual of activities - developmental, recreational, and computational - as a first stage. The selection of topics for instructional activities were based on

two considerations - mathematical significance and appeal to the interest and curiosity of students. The developmental activities were based on behavioral objectives. This resource manual was unstructured with regard to sequence of topics and placement of topics according to grade level.

The subsequent workshop in 1967 provided structure regarding grade placement of topics and continuity of the desired behavioral outcomes as they relate to mathematical concepts and skills.

IMPLEMENTATION OF THE PROGRAM

Any success in implementing this program has been due to the complete acceptance and support of this program by the administrators, curriculum staff, department chairmen, guidance counselors and teachers. An inservice course consisting of 15 meetings of two hours each has been offered during the 1967, 1968, and 1969 winter seasons. It has not been possible to accommodate all requests by teachers for this course since the enrollment each year has been limited to 25 teachers. This course has been under the leadership of Mr. Bolster with assistance from the supervisory staff and the writing committee. The Maryland State Department of Education with assistance from the state supervisor, Mr. Thomas Rowan, has granted two hours professional credit for teachers taking this course.

This mathematics program for slow learners is used in each of the 24 junior high schools in grades 7, 8 and 9, and in many senior high schools in grade 10. The scope of this program may be seen by an inspection of the enrollments in the current 1969-1970 school year.

Grade 7	-	1080 students	-- 46 sections
Grade 8	-	986 students	-- 44 sections
Grade 9	-	797 students	-- 36 sections
Grade 10	-	565 students	-- 26 sections

The principals in the schools have been most helpful in limiting the average size to 23 students. They have also provided for flexibility using the technique of parallel scheduling of classes. This provision allows a low achiever who may have overcome some of his difficulties to be easily transferred to a more advanced section. This procedure avoids "locking" a student in a slow learner section. The administrative expertise of principals in providing parallel scheduling is a desirable feature for any slow learner program.

Current plans include summer workshops in 1970 and 1971 to construct slow learner programs for Grades 11 and 12 respectively. It is hoped that these programs will emphasize mathematics which will be relevant to the world of business and industry.

BEHAVIORAL OBJECTIVES

The concept of behavioral objectives focuses upon the performance of the student. Since slow learners are poor performers, it was decided that behavioral objectives should be the foundation stone of the program. One should not infer from this that the use of behavioral objectives is the sole province of programs for the slow learner. Advocates of the behavioral objectives approach such as Gagne' (1), Mager (2), and Walbesser (3), claim that curriculum can be made more effective through precise statements of desired outcomes. Our county has just completed two other programs based on behavioral objectives: Applied Mathematics, a course for industrially-oriented boys, and a Self-Pacing Program in Algebra.

An integral part of any collection of instructional materials is a statement of the objectives. This is not new. This speaker can find in his files lesson plans constructed years ago which contained objectives such as:

OBJECTIVE: To present the construction of a parallelogram. When written in this fashion, the objective is achieved if the teacher completes the presentation before the period of instruction ends. It is often the case that although the teacher has achieved the objective, the student may still not be able to construct a parallelogram. Objectives stated in this fashion overlook the most important component in the instructional process; namely, the student.

In contrast, consider the behavioral objective:

OBJECTIVE: The student should be able to construct a drawing of a parallelogram using compass and straightedge.

This objective tells who is to perform, how he is to perform, a description of the conditions for the task, and what constitutes an acceptable performance.

To assess the acquisition of the above stated behavior, it is only necessary to give the student a compass, straightedge, pencil, paper, the lengths of two segments, and instruct him to make a drawing of a parallelogram. In response, the student can either make such a drawing or he cannot. In any event, it is possible to decide whether or not the stated objective has been realized. Any well stated behavioral objective should point clearly to the type of performance task necessary to assess its attainment.

The clarity of a behavioral objective such as the one stated (above) is in clear contrast to the vagueness of comparable objectives which state that the student should "understand the concept of the parallelogram." These and other objectives which use such terms and phrases as "to know", "to develop appreciations and attitudes", "to grasp the significance of", "to enjoy" do not lend themselves easily to evaluation. Indeed, the assessment of these qualities have always posed difficulties for researchers.

It should be mentioned, however, that objectives stated in this affective domain, are receiving considerable attention as evidenced by the recent publications by Krathwohl (4), and Mager (5). Thus, instead of dealing with the acquisition of concepts, understandings, and attitudes which are difficult to explain, more difficult to define, and even harder to evaluate, let us deal with actions which we can see the student do or hear him respond. These actions are usually termed behaviors.

Behavioral scientist Robert Gagnel (1) asserts that true learning involves a change on the part of the learner so that he no longer reacts as he did before. His whole being views and reacts to a familiar situation in a new way. Thus, learning is defined as the acquisition or change in behaviors. If our instructional program is to effect such changes in slow learning students, the objectives must be so constructed that they specifically state the desired behavioral responses which are observable and hence can be assessed.

COMPONENTS OF A WELL-CONSTRUCTED BEHAVIORAL OBJECTIVE

One of the most difficult problems which the writing committee encountered was that of constructing behavioral objectives. If a behavioral objective is well-constructed, it should not be ambiguous or open to possible misinterpretation by the reader. Our committee was guided by the list of the components of a well-constructed behavioral objective as proposed by Henry Walbesser (3):

1. Who is to exhibit the behavior?
2. What observable performance (action) is the learner expected to exhibit?
3. What conditions, objects, and information is given?
4. Who or what initiates the learner's performance?
5. What responses are acceptable?
6. What special restrictions are there on the acceptable response?

ACTION VERBS

Since the focus is on the observable, visible acts of the student, it is necessary that the description of the behavioral objective use action verbs which reduce their performance meaning to a minimum. Our committee adopted the nine action verbs proposed by Walbesser (3). Any activities performed in a mathematics class can usually be defined in terms of one of these nine verbs. It cannot be stated too strongly that this list of nine action verbs is not sacrosanct. Indeed, you may wish to employ other action verbs. It is crucial, however, that these verbs be defined so as to communicate precisely the intent of the writer of the objective without any possibility of misinterpretation or confusion by others. Thus, for our slow learner program, the following list of nine action verbs were used:

1. IDENTIFY: The student selects by pointing to, touching, picking up, or circling the correct object or class name. This class of performances also includes object properties such as rough, smooth, straight, curved.

   Example: The student should be able to identify the prime numbers from a given set containing prime and composite numbers.

2. DISTINGUISH: The student identifies objects or events which are potentially confusable. This is a more difficult identification.

   Example: The student should be able to distinguish between a square and a rectangle.

3. CONSTRUCT: a. The student generates a construction using instruments, a freehand drawing, or by building model.

Example: Given an angle drawn on a sheet of paper, a compass, and straight edge, the student should be able to copy the angle.

b. The student constructs an answer or example. The teacher is concerned only with the student's ability to construct the answer or example, not the method or procedure he uses in arriving at the solution.

Example: The student should be able to construct the product of a fraction and a whole number.

4. NAME:

a. The student supplies the correct name for a class of objects or events orally or in written form.

Example: The student should be able to name the associative property of addition in the set of whole numbers given an expression similar to

$$(6 + 3) + 5 = 6 + (3 + 5)$$

b. The student names the correct solution to a problem. This is different from "construct" in that an immediate response is expected. In this sense "name" is used in relation to the basic arithmetic facts which the students commit to memory.

Example: The student should be able to name the addition facts through 9.

5. ORDER: The student arranges or classifies two or more objects or events in proper order in accordance with a stated category. This verb is used when the student arranges something from largest to smallest, most to least, or fastest to slowest.

Example: The student should be able to order a set of whole numbers from largest to smallest.

6. DESCRIBE: The student states all the necessary categories or properties relevant to the description of a designated situation. The student's description must be stated so clearly that any other individual could use the description to do a task, identify an object, or perform an operation. The description is mostly verbal; however, a model, hand motions or a written example could be used to aid in the description.

The teacher must be willing to accept more than one response. For example, the student might describe something in terms of his surroundings, by using an example, or by stating a definition. The description may include color, size, shape, etc.

Example: The student should be able to describe sample spaces as ordered arrangements, listing all possible outcomes.

7. STATE A PRINCIPLE OR A RULE: The student makes a verbal statement which conveys a rule or a principle. This is more limiting than describing in that only one basic response is acceptable. Students may use their own words in stating the rule. For example, when asked

the question, "How do you find the area of a square?", a student may respond, "To find the area of a square, measure the length of a side, and multiply the number by itself," or "$A = s^2$" ---- both are acceptable answers. Any formula, theorem, or definition is a statement of a rule.

Example: The student should be able to state the principle that the circumference of a circle equals pi times the diameter, ($C = \pi D$).

8. APPLY THE RULE: The student uses a rule or principle to derive an answer to a question. The question is stated in such a way that the student must employ a rational process to arrive at the solution. Students might not be able to apply it.

Example: The student should be able to apply the principle of casting nines to check addition problems involving whole numbers.

9. DEMONSTRATE: The student shows a procedure or test for the application of a rule or principle. The teacher wants the student to show how he arrived at an answer, not just the answer alone. This usually involves some action, other than verbal, on the part of the student.

Example: The student should be able to demonstrate a procedure for finding the least common multiple of a given pair of numbers.

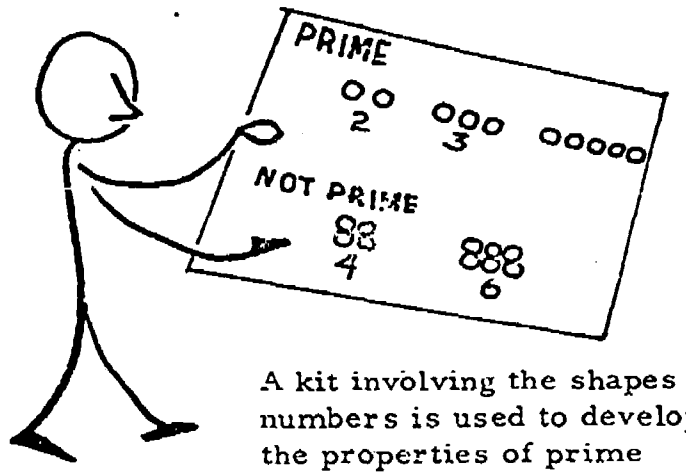
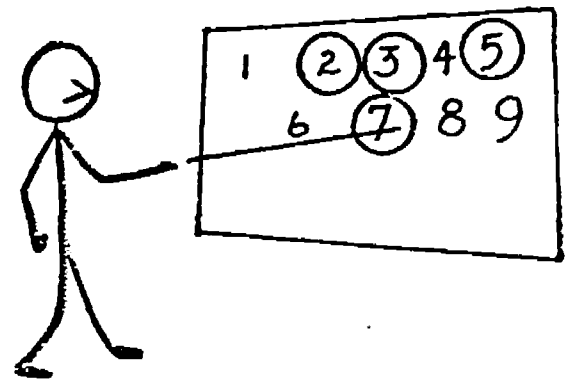
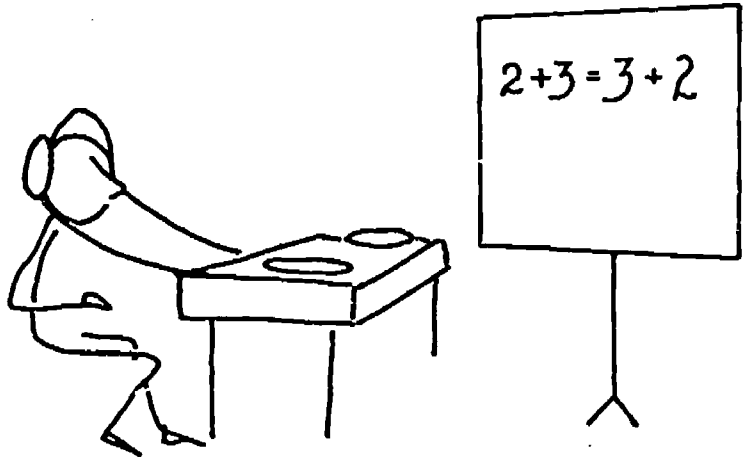
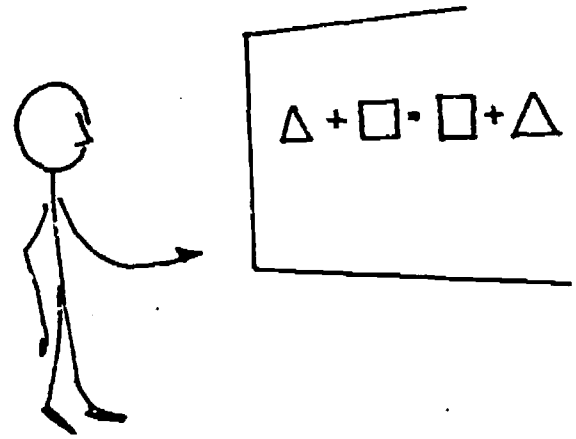
In his original listing of action verbs, Walbesser included a tenth action verb, "interpret" in which a student uses several rules or principles to draw conclusion or identifies objects and/or events in terms of their

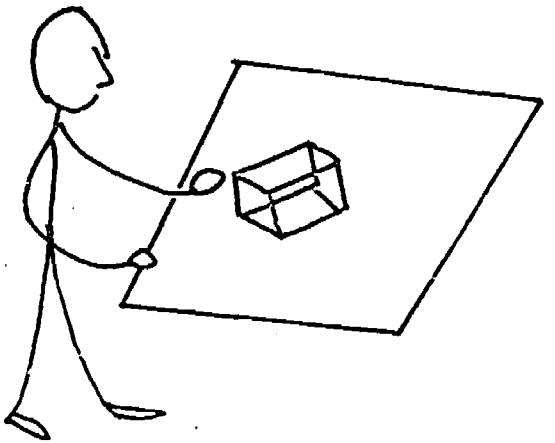
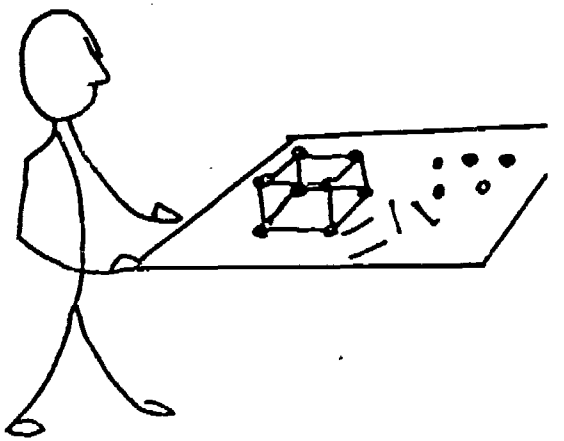
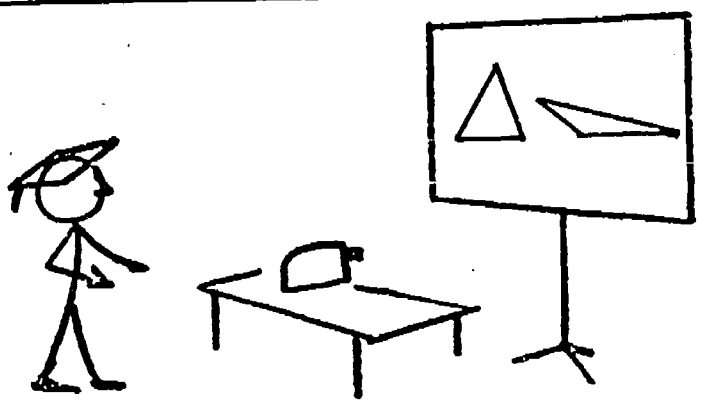
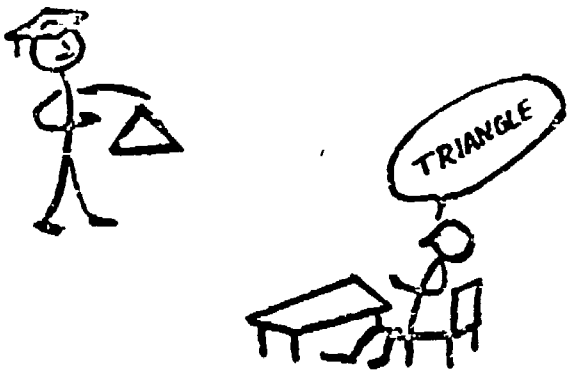
consequences. This is essentially a chain of behaviors. This verb is now omitted because the behaviors in the complex chaining are difficult to observe and assess.

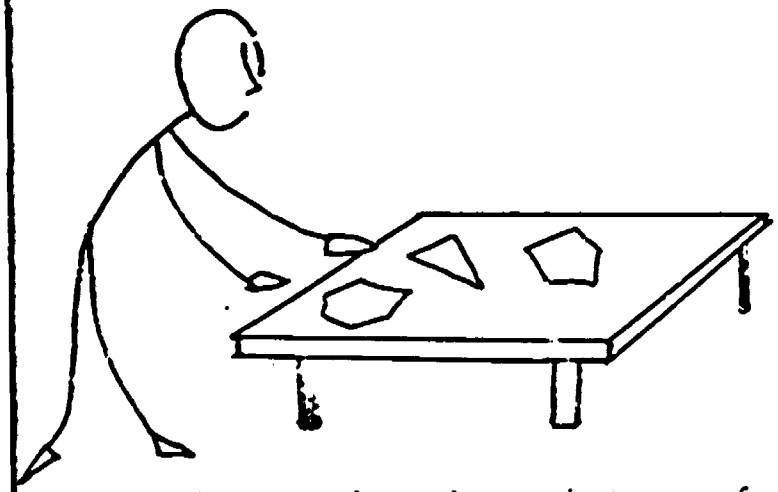
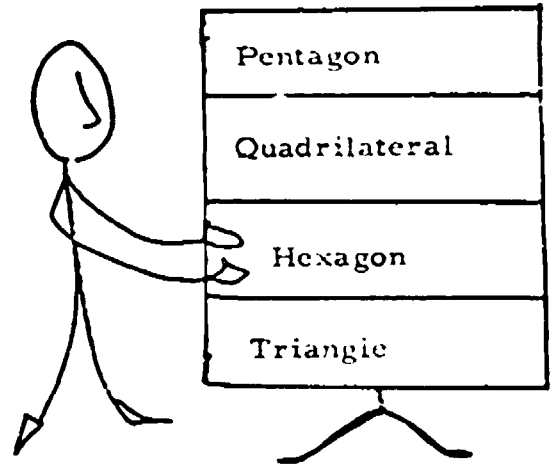
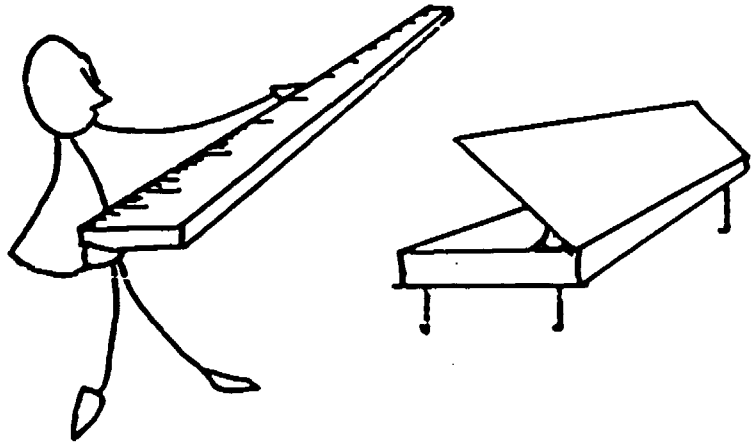
A program based on behavioral objectives may be likened to the triple play in baseball;

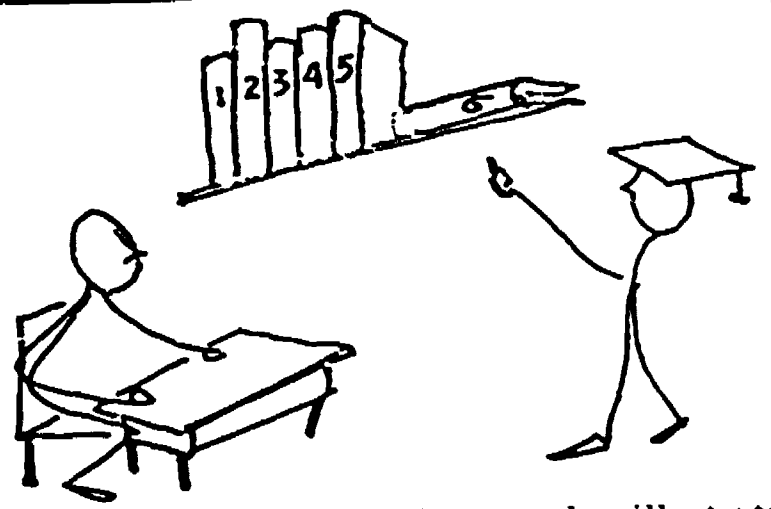
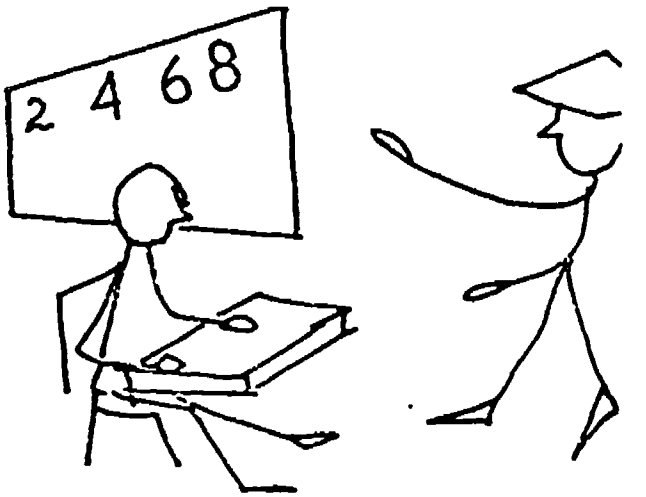
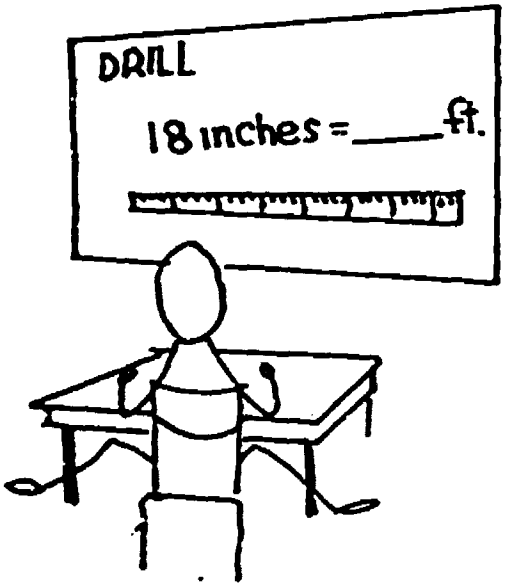
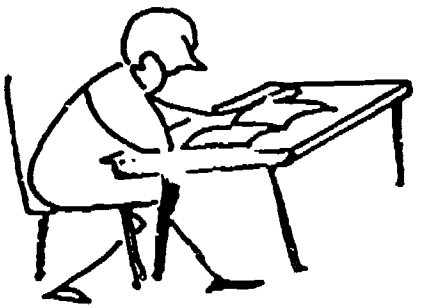
OBJECTIVES - INSTRUCTION - ASSESSMENT

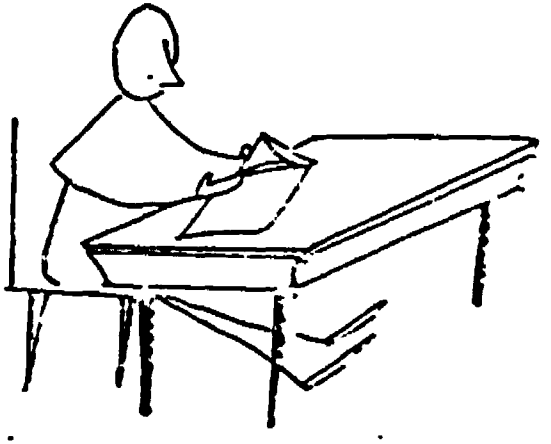
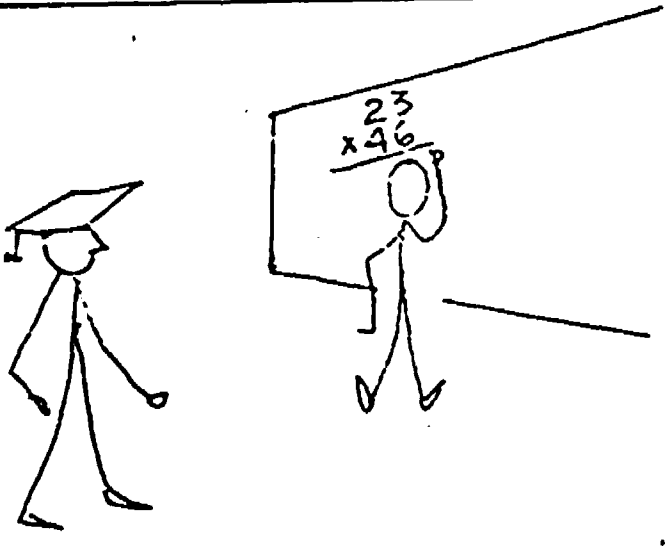
First, the objectives of the activities are stated in terms of the desired behavioral outcomes on the part of the student. Secondly, student activities are designed to achieve these outcomes. Finally, the suggested assessment procedures indicate ways in which the student shows whether or not he has acquired the desired behavior. In effect, there should be a one-to-one correspondence between the set of objectives, the set of learning activities, and the set of assessment items. The following examples should clarify the relationship.

OBJECTIVE	INSTRUCTION	ASSESSMENT
1. The student should be able to identify a prime number less than 25.	 A kit involving the shapes of numbers is used to develop the properties of prime numbers.	 Students are to circle the numbers which are prime.
2. The student should be able to distinguish among the commutative, associative and distributive properties of addition.	 A tape and filmstrip are used to present the properties.	 Students are given examples on the board and instructed to identify each property.

OBJECTIVE	INSTRUCTION	ASSESSMENT
3. The student should be able to construct a model of a cube given appropriate materials.	 Given straws and string make a model of a cube.	 Use toothpicks and gumdrops to build a model in the shape of a cube.
4. The student should be able to name a triangle.	 Filmstrip is used initially to present the name triangle.	 A model is used to assess the student's ability to name a triangle.

OBJECTIVE	INSTRUCTION	ASSESSMENT
5. The student should be able to order polygons in terms of increasing number of sides.	 Use models to order polygons in terms of increasing number of sides.	 Use the flannel board to order polyg in terms of increasing number of sid
6. The student should be able to describe a foot.	 Using kits students are introduced to the foot as a unit of measure.	 tudent may describe a foot y a hand motion

OBJECTIVE	INSTRUCTION	ASSESSMENT
7. The student should be able to state the principle that events which are certain to happen have a probability of 1.	 Six math books on a shelf are used to illustrate what is the probability of picking a math book if blindfolded.	 Student states "The probability of selecting an even number is certain t happen, so it has a probability of 1."
8. The student should be able to apply the principle that 12 inches equals 1 foot to convert a measure expressed in one unit to the other unit.	 A drill on converting inches to feet is used to introduce the topic.	 A written test is used for assessmen purposes.

OBJECTIVE	INSTRUCTION	ASSESSMENT
9. The student should be able to demonstrate a procedure for constructing the product of two whole numbers.	 Student uses book to work problems at his seat.	 Students show work at the board.

CONSTRUCTING THE INSTRUCTIONAL PROGRAM

The main goal of the 1966 summer workshop was to search for and construct mathematical activities which would be palatable for unmotivated and slow learning students. The commercial output at that time for such materials was limited. The committee made a selection of topics for mathematical activities on the basis of possible student interest and mathematical significance. These were developed in terms of behavioral objectives. The product was really an unstructured collection or smorgasbord of activities. These activities were tried in pilot schools. On the basis of informal evaluations by teachers, it was decided to provide more structure in terms of grade placement and sequencing of topics in the subsequent summer workshop.

In the 1967 workshop the committee really came to grips with the problem of constructing a mathematics curriculum for slow learners. Should the curriculum comprise a subset of topics usually presented to academic students or general noncollege bound students? Should the curriculum be completely different than that usually given to slower learning students? If so, what form should it take? What bases should be used for evaluating worthwhileness of activities? Will the expanding technology render much of today's mathematics obsolete for the slow learner? These and many other questions were raised by the committee. One of the most profound questions dealt with the values that should underlie all curriculum planning. The committee was aware of the difficulty in dealing with the problem of values using behavioral objectives. Although the committee firmly believed that a behavioral objectives approach would materially improve instruction in many activities, it was cognizant that an overzealous and inappropriate use of behavioral objectives might weaken the curriculum. There was general agreement regarding two pitfalls to be avoided.

1. The fact that an instructional activity lends itself well to specifying well-defined behavioral objectives is not sufficient justification for including that activity in the curriculum. In other words, the tail should not wag the dog.
2. Conversely, the fact that an instructional activity did not lend itself well to specific behavioral objectives is not sufficient cause for the exclusion of that activity from the curriculum.

The reader can find in the current literature lengthy discussions of an appropriate curriculum for slow learners usually couched in terms of the issues and values involved, and seldom in terms of a definitive curricular scope and sequence. Such articles often conclude with the hope that the future will bring forth solutions to the problem. However, the writing committee could not wait for answers in the future. The slow learners in Baltimore County were with us, here and now --- and in great abundance. The urgency of the situation prompted the committee to make a start using the best available sources, consultants, and the experience of dedicated teachers.

The NCTM Second Report of the Commission on Postwar Plans (6) was helpful in determining the terminal competencies for these noncollege bound students. The topical divisions of the curriculum guides are based on areas of mathematical competencies for the slow learner.

TOPICS

Numbers, Operations, and Algorithms
Geometry
Measurement
Graphing
Probability and Statistics
Algebra
Logic
Recreational Activities

Behaviors were assigned to each concept and skill in each area of mathematical competency. This information is shown in the curriculum guides by a series of charts -- a master chart and a grade level chart.

The master chart gives an overview of the mathematical content and behaviors which the students are to acquire in grades 7-10 in a particular area. As an illustration, the charts which follow list the desired behaviors horizontally across the top for the mathematical content in geometry listed vertically at the left.

The teacher can use the master charts to obtain a picture of the total mathematics program for the slow learning student. Furthermore, the teacher can see which behaviors are to be developed in grades 7-10 as well as the necessary prerequisite behaviors, and also those behaviors to be developed later.

UNIT GEOMETRY GRADE(S) Six through Ten

TOPIC	NAME	IDENTIFY	DEMON-STRATE	CONSTRUCT	DESCRIBE	STATE THE PRINCIPLE	APPLY THE PRINCIPLE	INTERPRET	ORDER	DISTIN-GUISHING
Point	6	6		6						
Line	6	6		6	6					
Plane	6	6		7	6					
Closed Path	6	6		6	6					6
Segment	6,7	6,7	7	6,7	6					6
Congruent Segments	9	9	9		9					
Ray	6,7	6,7		6	6					6
Angles	6,7	6,7	7	6	6					
Vertex	7	7			7					
Right Angles	6	6	9	6	6					9
Acute Angles	9	9		9	9					9
Obtuse Angles	9	9		9	9					9
Straight Angles	9	9		9	9					9
Vertical Angles	9	9		9	9	9	9			
Supplementary Angles	9	9		9	9					9
Complementary Angles	9	9		9	9					9
Congruent Angles	9	9	9	9	9					
Triangles	6,7	6,7	10	6	6					

UNIT GEOMETRY GRADE(S) Seven through Eleven

TOPIC	NAME	IDENTIFY	DEMON-STRATE	CONSTRUCT	DESCRIBE	STATE THE PRINCIPLE	APPLY THE PRINCIPLE	INTERPRET	ORDER	DISTIN-GUISHING
Equilateral Triangle	8	8	8	8	8					8
Isosceles Triangle	8	8	8	8	8					8
Scalene Triangle	8	8	8	8	8					8
Right Triangle	9	9	9	9	9					9
Acute Triangle	9	9		9	9					9
Obtuse Triangle	9	9		9	9					9
Perpendicular Lines	9	9	9	9	9					
Parallel Lines	7	7	9	7	7					7
Transversal	10	10		10	10					
Corresponding Angles	10	10		10		10	10, 11			
Midpoint	7	7	7		7					
Partitioning a Segment			11							
Quadrilaterals	7	7		7	7					
Trapezoid	7	7		7	7					7
Parallelogram	7	7	10	7	7	10	10, 11			7
Rectangles	7	7	10	7	7	10	10, 11			7
Square	7	7	10	7	7	10	10, 11			7
Rhombus	7	7	10	7	7	10	10, 11			7
Polygon	8	8		8	8					

UNIT GEOMETRY GRADE(S) Eight through Eleven

TOPIC	NAME	IDENTIFY	DEMONSTRATE	CONSTRUCT	DESCRIBE	STATE THE PRINCIPLE	APPLY THE PRINCIPLE	INTERPRET	ORDER	DISTINGUISHING
Pentagon	8	8	9	8	8				8	8
Hexagon	8	8	8	8	8				8	8
Octagon	8	8	8, 9	8	8				8	8
Congruent Triangles	10	10			10	10	10			
Similar Triangles	10	10			10	10	10			
Corresponding Sides of Similar Triangles						10	10, 11	10, 11		
Circle	6	6	7	6	6					
Radius	6	6	7	6	6	7				
Diameter	6	6	7	6	6	7				
Chord	7	7	7	7	7					
Tangent	8	8	10	8	8	10				8
Secant	8	8		8	8					8
Central Angle	10	10	10	10	10					10
Inscribed Angle	10	10	10	10	10	10				10
Ellipse	10	10	10	10	10	10				
Angle Bisector	9	9	9	9	9	9				
Sum of Interior Angles of Triangles						9	9			
45°			9	9						
60°			9	9						

UNIT GEOMETRY GRADE(S) Seven through Eleven

TOPIC	NAME	IDENTIFY	DEMONSTRATE	CONSTRUCT	DESCRIBE	STATE THE PRINCIPLE	APPLY THE PRINCIPLE	INTERPRET	ORDER	DISTINGUISHING
30°			9	9						
Median Triangle	7	7	-	7	7	7				
Altitude of Triangle	9	9	9	9	9					
Cube	7	7		7	7					7
Rectangular Solid	7	7		7	7					
Pyramid	8	8		8	8					
Cone	8	8		8	8					
Cylinder	8	8		8	8					
Sphere	8	8		8	8					8
Line of Symmetry	8	8		8	8					
Sum of Interior Angles of Quadrilaterals						9	9			
Sin	11	11				11	11	11		11
Cos	11	11				11	11	11		11
Tan	11	11				11	11	11		11
Trig Tables	11	11		11				11		
Other Polyhedrons	11	11		9,10						
Pythagorean Theorem						10	10			
Region	7	7		7	7					
Sum of Interior Angles of a Polygon						8	8			

The grade level charts for each area are identical to the master chart except that they contain only the information for a specific grade. As an illustration, the charts which follow list the desired behaviors horizontally for each of the geometric concepts in Grade 7 listed vertically.

These grade level charts can be used to obtain an overview of those behaviors which should be acquired by the student in a specific area of mathematical competency for that particular year.

UNIT GEOMETRY GRADE(S) Seven

TOPIC	NAME	IDENTIFY	DEMON-STRATE	CONSTRUCT	DESCRIBE	STATE THE PRINCIPLE	APPLY THE PRINCIPLE	INTERPRET	ORDER	DISTIN-GUISHING
Plane				7						
Segment	7	7	7	7						
Ray	7	7								
Angles	7	7	7							
Vertex	7	7			7					
Triangles	7	7								
Parallel Lines	7	7		7	7					7
Midpoint of Segment	7	7	7		7					
Quadrilaterals	7	7		7	7					
Trapezoid	7	7		7	7					7
Parallelogram	7	7		7	7					7
Rectangles	7	7		7	7					7
Square	7	7		7	7					7
Rhombus	7	7		7	7					7
Circle			7							
Radius			7			7				
Diameter			7			7				
Chord	7	7	7	7	7					

UNIT GEOMETRY GRADE(S) Seven

TOPIC	NAME	IDENTIFY	DEMON-STRATE	CONSTRUCT	DESCRIBE	STATE THE PRINCIPLE	APPLY THE PRINCIPLE	INTERPRET	ORDER	DISTIN-GUISHING
Median Triangle	7	7	7	7	7	7				
Cube	7	7		7	7					7
Rectangular Solid	7	7		7	7					
Region	7	7		7	7					

To assist the teacher in helping students attain the desired behaviors given in the charts, the committee constructed for each grade a list of behavioral objectives which may be found immediately after the chart. A sample page of these objectives appears on the following page. These objectives enable the teacher to interpret the details omitted in the chart. The teacher uses these objectives when planning lessons since they state precisely what is expected of the student. The objectives are not necessarily taught in the order presented; instead, objectives from several areas may be used in order to develop the topic under consideration. However, by the end of the year, the students should be able to exhibit most of the behaviors mentioned.

Included in this section on behavioral objectives are coded references to student activities which have been developed. These activities have been specifically designed to bring about the desired behavioral changes indicated in the objectives. This code assists the teacher in identifying the type of activity which might be used when developing a particular topic.

Page

Triangles

The student should be able to:

1. Name and identify the symbol for a triangle

Parallel Lines

The student should be able to:

1. Name and identify the figures and symbols for parallel lines
2. Construct a drawing of parallel lines using a straightedge or freehand sketch
3. Describe parallel lines as lines that go in the same direction, but never meet
4. Distinguish parallel lines from non-parallel lines

Quadrilaterals

The student should be able to:

1. Name and identify a quadrilateral — GE-14
2. Construct a drawing of a quadrilateral using a straightedge or freehand sketch
3. Construct a model of a quadrilateral with available materials — GE-16
4. Describe a quadrilateral in terms of his surroundings or as a closed four sided figure

Parallelograms, Rectangles, Squares

The student should be able to: — GE-13

1. Name and identify the figures and symbols — GE-16
2. Construct drawings using a straightedge or freehand sketch
3. Describe a parallelogram in terms of their surroundings or as a quadrilateral with opposite sides parallel — R-28

THE "BANDED" APPROACH

A presentation of the program would not be complete without a discussion of a technique which we feel is basic for teaching slow learners and is built into the program. Teachers who participated in the experimental program the first year developed a method of teaching which seems to be effective for the slow learner. The rationale is based upon one of the traits of the slow learner ---- a limited span of attention. The key to the success of this method is that a variety of mathematical topics is incorporated into each lesson. Naturally, small group instruction, individual lab work, extensive use of audio-visual aids, mathematical games and the like provide the variety of activities within the lesson to change the pace when working with this low ability student. Thus, the student is exposed to a program of instruction which provides a variety of activities as well as a variety of mathematical content within a given classroom period. This method of teaching will be refered to as the "banded approach".

To elaborate further, the "banded approach" is a flexible way of organizing instructional activities in the class period. Normally, the lesson is divided into three time bands, although sometimes it may be divided into two or even four time bands, depending on the nature of the activities. For example, a unit in Geometry might be taught along with related activities on Fundamental Operations. Thus the unit in Geometry is split into smaller parcels and presented over a longer period of time rather than being presented as a two week concentrated unit. Thus, the major portion of the lesson might be presented during a 25 minute segment since this seems to be about the maximum length of time these students can concentrate on any one activity.

Band I is usually a short activity of about 5-10 minutes duration. For example, students may review their addition facts using the Math Builder controlled reader projector, have an oral number puzzle, or complete a number pattern. The activities for maintaining skills and arousing curiosity which might be used are numerous.

Band II usually contains the major topic for the day. It is about 25 minutes in length. For this activity, specific behavioral objectives are stated. Students are exposed to instructional activities which are designed to enable them to acquire the desired behaviors. Assessment procedures might also be employed here to determine whether students have acquired some of the behaviors specified in the objectives. Remaining objectives may be assessed in other bands of subsequent lessons.

Band III is usually a short activity of 5 to 10 minutes. This band can be managed in two ways. First, all the students might begin work at the same time on a class activity. Second, as each student completes his work in Band II he begins some planned individual or small group activity. For example, after a student has completed his work from Band II, he may go to a specified place in the room and pick up an interesting puzzle or game, work on one of the SRA Computational Skills kit, or listen to a tape at the listening post. This approach keeps the students actively involved in learning activities rather than just waiting for the class to finish the work in Band II. Thus, a more efficient use is made of the student's time.

Another reason for including the banded approach is the necessity of providing continuous experiences for maintenance of computational skills. Research in our neighboring system in Baltimore City shows that low ability students provided with continuous experiences in computational skills reach a maximum which serves as a plateau. However, if experiences in maintaining skills are withdrawn, a marked decrease in these skills results. Thus, each lesson using the banded approach makes provision for some type of maintenance of computational skills.

The above descriptions indicate a general outline of what constitutes the banded approach. Flexibility is the key. Teachers vary the number of bands as well as the length of time devoted to each depending upon what topic is being presented.

It was impossible in a six week workshop to devise activities for each behavioral objective for each of the seven areas of mathematical competencies. Dr. Sobel, who served as one of the consultants, suggested the construction of a two week sample unit which could be used at the beginning of the school year as a detailed illustration of the use of the curriculum guide. In the curriculum guide for each grade there appears a sample two week unit which contains:

1. A block plan indicating the topics to be presented each day.
2. Detailed lesson plans indicating the materials to be used, the behavioral objectives, suggested methods for presentation, student worksheets, and assessment items.

As an illustration, the following page contains a sample two week banded unit for the Grade 7 curriculum guide. Thus, this sample two week unit provides a model from which the teacher can create other units utilizing the same approach. Plans are underway to construct additional units in an inservice program which is being given at this time.

SAMPLE UNIT OF BANDED LESSONS - Grade 7

OUTLINE OF TOPICS

LESSON	BAND I	BAND II	BAND III
1	Drill-geometric figures	Parallel lines	4-digit numbers
2	Drill-patterns	Symbols for segment and ray, assessment of parallel lines	Puzzle-optical illusions
3	Math Builder	Copying segments -straightedge	Tape-addition
4	Puzzle-multiplication and addition	Copying segments -straightedge and compass	Math Builder
5	Math Builder	Assessment- copying segments	Cross Number Puzzle-place value
6	Drill-patterns	Midpoint-paper folding	Construction of ruler
7	Math Builder	Midpoint-compass and ruler	Puzzle-multiplication and addition
8	Puzzle-division	Assessment-midpoints	Cross Number Puzzle-multiplication
9	Math Builder	Symbols for angle, vertex	Puzzle-renaming numbers
10	Tape-verbal problems	Copying angles-compass and straightedge	Tic-Tac-Toe game
11	Diagnostic Test-addition of whole numbers	Copying angles	Continuation of Tic-Tac-Toe game
12	Puzzle-calendars	Assessment-copying angles	Puzzle-hidden words

STUDENT ACTIVITIES

The major divisions for each area of mathematical competencies contain a series of suggested activities. For each activity a Teacher Commentary is printed on yellow paper. This commentary indicates the title of the activity, the unit, the behavioral objectives, necessary materials, a procedure for implementation and suggested assessment items. Student worksheets are printed on white paper and immediately follow the Teacher Commentary. The teacher can use these white student sheets as a master copy to reproduce work copies for the student. This can be done by taking the master copy out of the curriculum guide, and making a thermal spirit master or an overhead projectual. The master copy is returned to the guide for future use, and the thermal spirit master is then used to run off copies for the students.

As an illustration, the following pages include a Teacher's Commentary and Student Worksheets for the activities in Lesson 2 in the sample two week banded unit shown on page 33.

LESSON 2

I. Unit: Geometry

II. Objectives: The student should be able to:

Name and identify the symbols for segment and ray

III. Materials:

A. Band I - None

B. Band II - Work sheet entitled, "Fancy Figures"

C. Band III

1. Work sheet entitled, "The Eyes Have It"

2. Ruler and pencil

IV. Procedure:

A. Band I - Written Drill Involving Patterns

1. Have this drill written on the board for students to do as they come into the room.

2. Drill: What Comes Next? Place the missing numbers in the blanks provided.

a. 1, 3, 5, __, __, __, 13, __, __

b. 3, __, 9, __, __, 18, __, __, 27

c. 15, 12, 9, __, __, __

d. 15, 18, __, __, 27, __, __, __

3. Discuss patterns and answers with students.

4. Have students place their scores in the margins of their papers (same as yesterday).

5. Have students put their drill papers into their notebooks.

B. Band II - Lines, Segments, Rays

1. Tell students that you are thinking of a geometric figure that is represented by a straight, level road. What figure am I thinking of? (line)

2. Ask students to name other physical representations of lines.

3. Write the word line on the chalkboard and then have a student draw a representation of a line.

4. Help students name the line using the symbol for line, e.g. $\overleftrightarrow{AB}$.

5. Using the same procedure outlined in steps 1-4 above, develop the symbol for segment, e.g. $\overline{AB}$.

6. In a similar manner, develop the symbol for ray, e.g. $\overrightarrow{AB}$

7. EMPHASIZE that A is the end point of this ray.

8. When you feel that students can name these three geometric figures, have them complete the work sheet entitled, "Fancy Figures."

C. Band III - The Eyes Have It

1. As each student completes his work sheet from Band II, he should begin the work sheet entitled, "The Eyes Have It." The work sheet should be placed somewhere in the room where each student may get his copy when he is ready and begin working.

2. Be sure to give students help in following directions, if necessary.

3. Solutions to "The Eyes Have It"

1. True	4. True	7. True
2. True	5. True	8. True
3. False	6. False	9. True

FANCY FIGURES

Draw a line from the figure or symbol in Column I to the word it matches in Column II.

Column I	Column II
1. ||	Plane
2. ←→	Point
3. . L	Symbol for parallel lines
4. ———	Line
5. ——→	Ray
	Segment

Using a straightedge, make a drawing of each of the following:

6. Parallel lines

8. A plane

7. Non-Parallel lines

Use symbols to name each of the following geometric figures.

9. R S

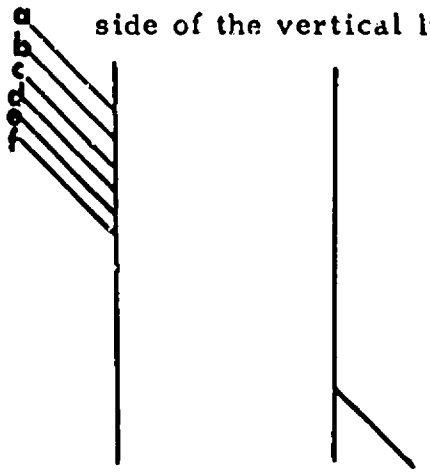
10. M N

11. X Y

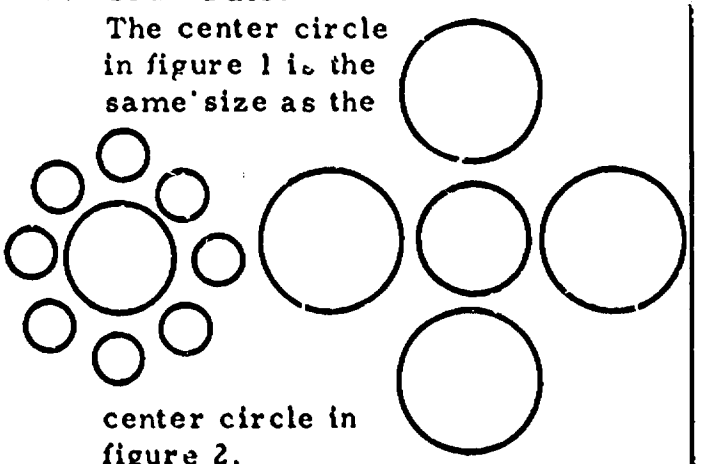
THE EYES HAVE IT

Study each problem carefully. Underline the correct answer that tells if the statement is true or false.

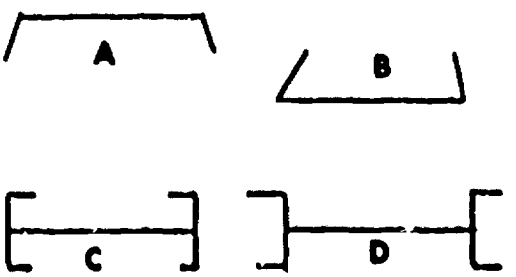
1. True - False
Line c is the line on the right side of the vertical lines.



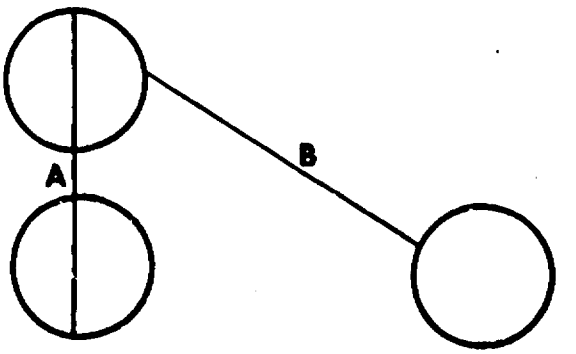
2. True-False
The center circle in figure 1 is the same size as the center circle in figure 2.



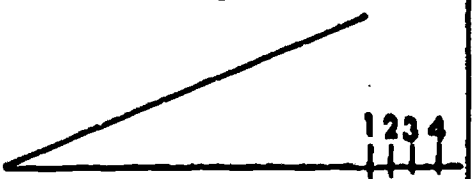
3. True - False
Line B is the longest of the four straight lines.



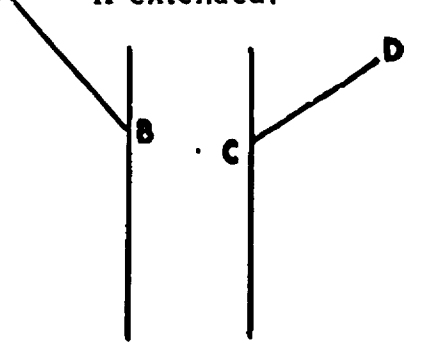
4. True - False
Line A and line B are the same length.



5. True - False
The upper segment will extend as far as the number 2 on the lower segment.

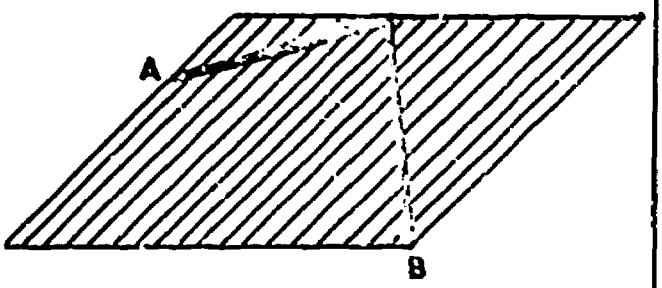


6. True - False
Line AB will intersect line CD to form a square corner at point C, if extended.

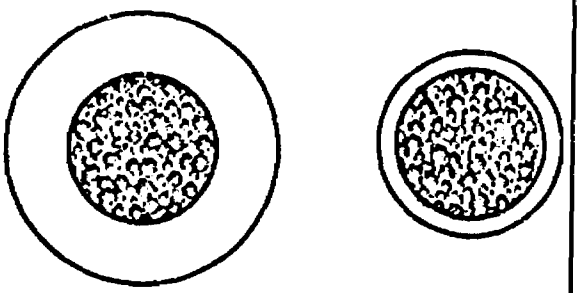


Ten minutes are almost up and you still have 3 more to do!!

7. True - False
Lines A and Pencil B are the same length.

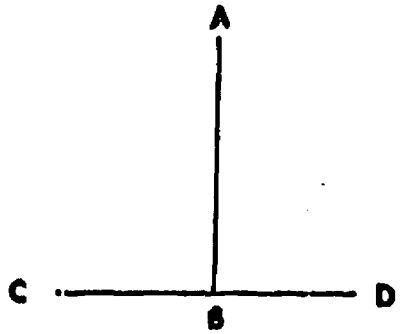


8. True - False
The shaded regions in both



figures have the same amount of space inside.

9. True - False
Segment CD is greater in length than segment AB.



Scores:

9 correct - Excellent

8 correct - Good

6-7 correct - Fair

5 or less correct - Your eyes deceive you badly.

SCORE:

Name:

The Student Activities section also includes references to student kits which have been teacher made or commercially produced, tapes, programed materials and films. These are used with small groups or with individual students.

The Recreational Activities section of the guide is quite different from the sections dealing with mathematical competencies. These activities are designed to develop a positive attitude towards mathematics. There are no behavioral objectives specified for this section. Games and puzzles play an important role in this section. These activities are to be used throughout the year for motivational purposes, and are used extensively in the Band III.

CONCLUSION

Much work still remains to be done. Additional units and activities need to be constructed. Teachers need to be trained to use this approach. New commercially produced materials designed for the slow learner have to be analyzed with regard to behavioral objectives and included in the guide. Thus, we view our first efforts as simply scratching the surface. However, these efforts have shown the feasibility and practicality of using a behavioral objectives approach so that they have immediate application in the classroom.

One of the urgent needs at this time is continued research with regard to a second and third dimension of the behavioral objectives approach. It was not possible for our workshops to consider these dimensions due to the short period of time and limited resources and personnel. The second dimension includes the construction, validation, and refinement of learning hierarchies which deal with terminal and the prerequisite subordinate behaviors. The third dimension refers to the use of objectives which emphasize an emotion, attitude, a degree of acceptance or rejection, and values. It is hoped some fruitful results will be available in the near future to assist us in dealing with the problem of the slow learner.

In preparing this presentation, the speaker set forth a behavioral objective:

OBJECTIVE: The state supervisor, after hearing this presentation and upon return to his school system, should be able to describe a program for slow learners using behavioral objectives to supervisors and teachers throughout his state.

The instructional activity for this objective has been this presentation. What about the assessment? Has this desired behavior been achieved? This assessment must of necessity depend upon what action you take upon your return to your home state.

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2. Robert F. Mager, Preparing Instructional Objectives (Palo Alto: Fearon Publishers, 1962).

3. Henry H. Walbesser, Constructing Behavioral Objectives (College Park: The Bureau of Educational Research and Field Services, University of Maryland, 1968).

4. D.R. Krathwohl, B.S. Bloom, and B.B. Masia, Taxonomy of Educational Objectives, Handbook II: Affective Domain New York: David McKay, Inc., 1964).

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The Madison Project in Philadelphia

Alan Barson
Madison Mathematics Coordinator
Philadelphia School System

The Madison Mathematics program started in Philadelphia in August of 1967. Provision for the program consisted of one resident coordinator and funding for staff development and instructional materials. Since that initiation, a number of aims peculiar to the situation in Philadelphia and the goals of the school administrators have been created by the coordinator.

The realization of these aims is embodied in the following activities originated during the term of the present coordinator (February, 1968):

1. In-service programs are continuous throughout the school system from Pre-K to 12th grade. Provisions have been made to train leaders in this endeavor (programs are city-wide, district-wide and school-wide). Most programs are voluntary and teachers are not paid for attendance. However, some programs provide for compensation in terms of materials or money. These funds are provided by the school district, and both kinds of workshops are heavily attended. The Madison program does provide funds for leadership training courses which promote far reaching results. Hundreds of teachers have been exposed to Madison in this fashion.
2. Television programs (primary, intermediate and in-service) are shown each week to all interested classes as an aid for continuous development. Many teachers and children are deeply affected.
3. A six-week summer training program at Syracuse University for the concentrated training of leaders has also been in existence for the past three summers.
4. Administrators, parents, and para-professionals are trained at night and on week-ends gaining support, insight, and clarity from the community.
5. Assistance in the creation of a Problem Clinic where educators can

go to obtain advice, counseling and materials for immediate use in the classroom is growing.

6. A university related six-week summer school has been organized where Madison techniques are demonstrated and explored as a graduate course in education.
7. Most important, the Associate Director of Instructional Services, Dr. Staples, and the Director of Mathematics, Karl Kalman, have been instrumental in promoting the development of the Madison program in the Philadelphia schools. Both men are highly dedicated to innovation and to providing programs to aid children's development. Without their support, the job of Coordinator would be extremely difficult.

The objectives for the Madison Project can be stated as follows:

1. To bring about an increased use of physical materials in the classrooms with the hope of eventually setting up mathematics laboratories in each school.
2. To promote increased use of small-group and individualized instruction in the mathematics classroom.
3. To bring about a unification of arithmetic, geometry and algebra (plus some science) into a simple coherent subject.
4. To provide for an early introduction of the big ideas of mathematics; eg., variables, open sentences, cartesian coordinates, functions, graphs and signed numbers.
5. To develope a creative approach to mathematics including the use of student discovery and exploration.
6. To provide in-service education for all elementary teachers and secondary mathematics teachers.
7. To train intensively leaders in each district, hopefully in each school, to carry on the ideas in Madison Mathematics.
8. To bring the programs into the pre-kindergarten and kindergarten rooms.

PART III

SUMMARIES AND ANALYSES OF THE FIVE PROGRAMS

In this part of the report the summary and the analysis of each of the five programs presented at the conference are given. In each case the summary paper prepared by the person presenting the program is given first. Following this is a summarization of the analyses of the program as made by the four small groups. The final section of this part of the report is a statement of conclusions arrived at from the summaries and analyses regarding the points that appear to be characteristic of successful mathematics programs for low achievers.

COLAMDA

Terry Shoemaker
Douglas County Schools
Castle Rock, Colorado

COLAMDA (Committee On Low-Achievers in Mathematics - Denver Area) is a curriculum development and teacher training project funded under the provisions of Title III, ESEA. The cooperative project, incorporating thirteen Metro-Denver Area school districts, was created as a result of representatives from local districts, University of Denver, and the Colorado Department of Education identifying a need for the development of an effective program model for low-achievers in mathematics, grades 7-12.

Each participating teacher has been selected by his/her curriculum director or math supervisor based on his/her commitment to develop a better learning atmosphere. Each teacher is currently teaching a class of Basic or General Math students.

The project provides an opportunity for teachers to become a part of a working model through individualized training in instructional techniques and methods, exploration, experimentation, idea exchange and material preparation.

The teacher training segment of the project places primary emphasis on favorable teacher attitude change toward the teaching of the low-achiever, identification of known successful instructional techniques and methods, development of realistic objective and transposition of pure math theory into a usable form for low-achiever instruction. Each new project participant is required to attend a workshop designed on the above concerns. The workshop staff has consisted of Dr. Ruth Hoffman, University of Denver Mathematics Department; Mr. Glyn Sharpe, Colorado Department of Education; and Mr. Terry Shoemaker, COLAMDA Project Director.

Learning activities and teacher "idea cards" have been prepared by a project writing team to assist the teacher in personalizing instruction by supplementing the existing district materials. The activities are intended to be student-interest oriented and "open-ended" in structure to provide for individual differences in math skill development, interest and age levels.

Geographical Land Area: 2,300 square miles

Area Population: 1,015,350

	Public School	Non-Public School	Total
Participating Schools	35	1	36
Participating Teachers	42	1	43
School Enrollment (Grades 7-12)	116,413	4,593	121,006
Project Class Enrollment	1,870	36	1,906

Rural/Urban Distribution*

Rural - 8.2%		Urban - 92.8%	
Farm	Non-Farm	Low-Socio Economic	Other
2.1%	6.1%	38.6%	53.2%

Ethnic Group Distribution*

White	Negro	American Indian	Mexican American	Other
62.5%	19.9%	.2%	17.3%	.1%

Average Achievement Level of Project Students** (Grade Placement)

Junior High - (Grades 7-9)	Senior High - (Grades 10-12)	Total - (Grades 7-12)
5.64	6.90	6.03

COLAMDA Project objectives and evaluation activities:

1. To enhance the mathematical performance of low achieving students without adversly effecting performance in other areas. The attainment of this objective is:

    a. An increase of one year or more in performance on standardized mathematics tests administered as pre and post tests.

    b. An achievement of eighty percent proficiency on teacher prepared unit tests.

    c. A pattern of performance in other subject areas consistent with performance in the mathematics class.

2. To effect more favorable student attitude toward mathematics and his/her mathematics class. The attainment of this objective will be evident if there is:

    a. A change in student's feelings about mathematics as measured on pre and post opinionnaires, an interview of a sampling of

*Percent based on total project enrollment.
**Based on Stanford Achievement Test - Advanced Battery.

students, and reports of critical incidents observed by teachers.

b. Increased confidence in ability to do mathematics as reflected by scores on an instrument designed to elicit response on how a student perceives his own mathematical skills.

3. To effect more favorable teacher attitude toward teaching low-achiever mathematics. This objective will be attained if there is:

a. An increased commitment by each teacher to working with low-achievers in mathematics. This commitment will be measured by responses of teachers in an interview, with additional information gathered from steering committee observations, building principal observations, and on observations by the project staff.

b. Evidence of flexibility and adaptation in using material and equipment in an effort to adapt to individual differences of students. Data on this will be from interviews, material inventory and observation of laboratory usage.

4. To have developed or selected materials and teaching aids that have been field tested. This objective will be attained if there is:

a. An increased quantity of individualized mathematical materials for low-achievers in the schools. The quantity will be measured through an inventory of materials.

b. Evidence of the appropriateness and effectiveness of the materials. This will be measured by student performance on tests after using material, and teacher judgments about the material as elicited through interviews and recording of critical incidents.

c. A contribution of project material to total mathematics curriculum of each district. The contribution will be determined by content analysis of the materials.

5. To have collected data on mathematics skills necessary for everyday living and considered important for job skills. This objective will be attained if:

a. The knowledge of mathematical content and/or skills required for entry level jobs in the area is determined. Information will be collected in the Denver area and used for material development. A content analysis of material and quantity of material as directly related to mathematical skills of jobs will be the major means of evaluation.

b. The knowledge of mathematical content and/or skills necessary for "everyday living" is adequately defined. A content analysis of, and quantity of material directly related to daily consumer mathematics.

Implementation Costs:

(All the following figures include only materials, equipment, etc., thus do not reflect expense of writing team, staff and administrative costs for forty-three teachers representing thirty-six school buildings.)

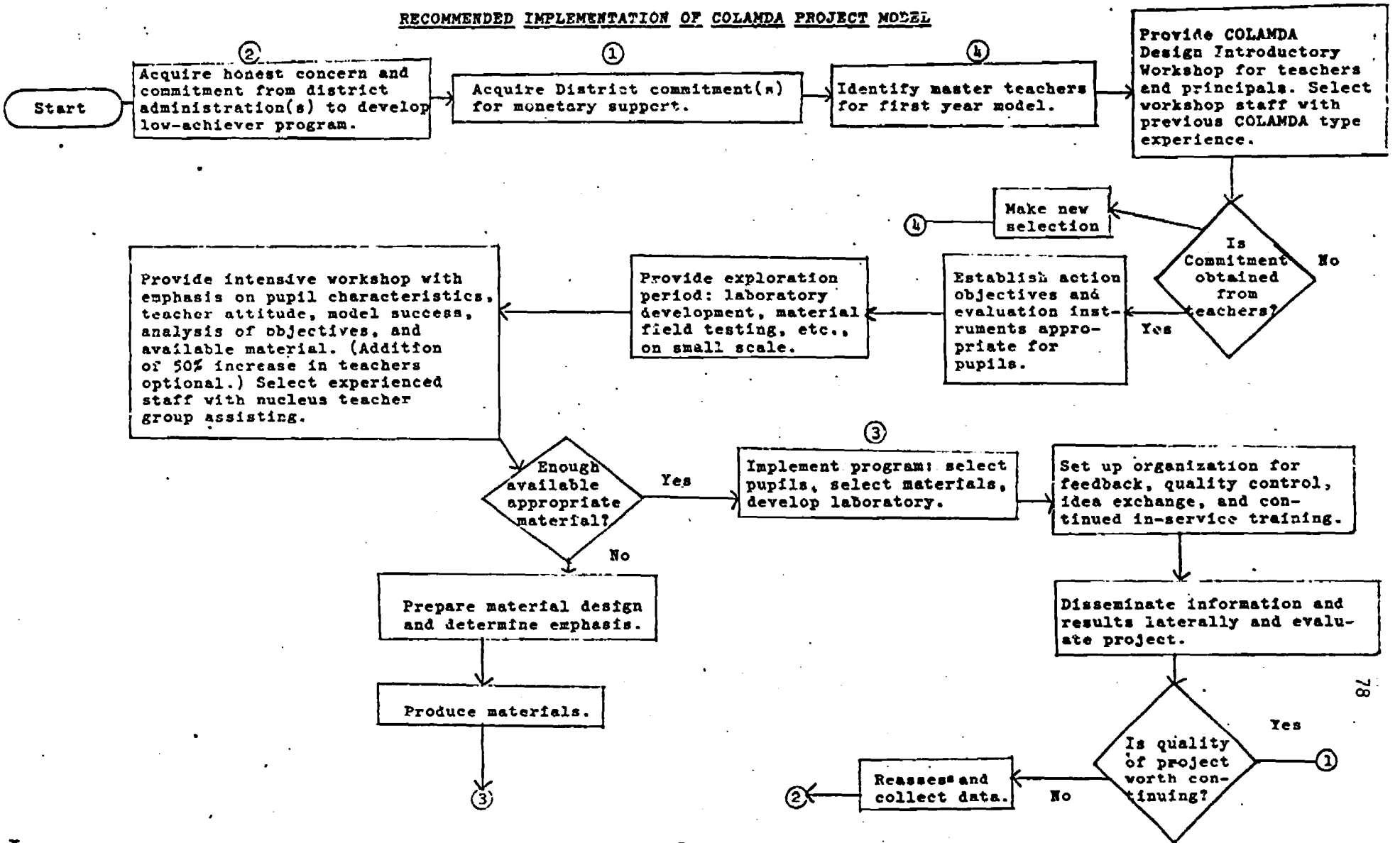
Material and Equipment:

Production of instructional aids, games, puzzles, concrete materials. 4 Sets per teacher	$ 1,008.00
Rental - Two adders and one calculator per building (adders at $10 per month; calculators at $30 per month).....	13,500.00
Reproduction of student materials and teacher cards.....	8,100.00
Production of clear and color transparencies. 1 Set per teacher	600.00
Film for production of media packs. 6 Copies per pack	300.00
Paper supplies including adder tape, poster board, duplicator paper, envelopes.....	1,252.00

Training:

Workshop tuition for twenty-two teachers. $105 per teacher	2,310.00
Two-week stipend for twenty-two teachers. $75 per teacher per week	3,300.00
Substitute teachers during "feedback" sessions.....	2,760.00

RECOMMENDED IMPLEMENTATION OF COLAMDA PROJECT MODEL



COLAMDA PROJECT

Summary from Small Group Sessions of Characteristics which Seem to Contribute to the Success of this Program.

Personnel

The project identifies master teachers as pilot teachers and provides paraprofessional assistance. The teachers in the project show empathy for low achievers and are committed to the project. The project is obviously supported by the administration of the districts and has the cooperation of the State Department of Education and university staffs. By no means least important is the enthusiasm and ability of the Project Director.

Materials

The materials are action-oriented for pupils, supplementary in nature, and well organized and keyed to the program objectives. The materials are closely related to pupil interests and are partially developed by teachers. As a result, the materials seem to be well organized for individualized instruction.

Student Activities

A laboratory atmosphere pervades all instructional activities. The program, as noted, is activity-centered and provides for a degree of individualized study. There are no time constraints or topic requirements, but rather a large variety of activities are available to suit the interest and ability level of the child.

Planning and Evaluation

The planning procedures are jointly developed by teachers, project staff, and administration from the cooperating districts. The early commitment secured from the local districts insures the planning and implementation procedures.

The programs objectives are stated. Objectives exist for both the program and the students. The objectives are measurable. Tests are available for measuring pupil achievement, and evaluation instruments have been developed and used to assess project effectiveness.

Administration

The project seems dependent on an enthusiastic director and strong administrative support from the 13 participating districts. In turn the administration is dependent on the strengths of the project teachers. To insure such strength, the in-service staff includes representatives of the local districts, the State Department of Education, and a university.

The project has a written commitment to dissemination and public relations to the greatest extent possible.

Other

The in-service experience provides for both workshops and feedback sessions. Information about the project is available from the Director. In addition, "Colamda Model Design" is available at nominal cost. The "Design" is an information source for administrative staffs of interested districts.

An expanded second phase indicates some degree of success.

THE PHILADELPHIA-UNIVERSITY OF ILLINOIS COMMITTEE ON SCHOOL MATHEMATICS COOPERATIVE PROGRAM FOR UNDER-ACHIEVERS --STRETCHERS AND SHRINKERS--

Leonard W. Sloan
Coordinator
Philadelphia-UICSM Under-Achiever Program

A Report Prepared for the Association of State Supervisors of Mathematics (ASSM)

Brief History - Stretchers and Shrinkers

In 1963, two prominent mathematics educators, Professor Max Beberman and the late Professor Bernard Friedman began the development of a new course for underachieving mathematics students. The name of this course was Stretchers and Shrinkers. They were soon joined in their efforts by Professor Peter Braunfeld. All of them reasoned that a fraction was a composite of a stretching operator and a shrinking operator. They also thought that this approach to fractions would be appealing which would lead to success for junior high school students who required remedial work in fractions. So you see, this course is really about fractions.

The various editions of Stretchers and Shrinkers were tried out in schools across the nation - namely Los Angeles, California; Honolulu, Hawaii; Champaign and Urbana, Illinois; Newton, Massachusetts; Philadelphia, Pennsylvania; and Memphis, Tennessee.

Characteristics of the Pupils of the School District of Philadelphia

The School District of Philadelphia has many types of students. Academic high schools as well as comprehensive and vocational-technical high schools provide for their needs. However, there exists a hard core pocket of students for which the conventional curricula do not apply.

This latter group of students is sometimes characterized as:

1. being under-achievers, academic drop outs, underprivileged, reluctant learners, and disadvantaged.
2. coming from all social-economic levels of rural, suburban, and urban life, but primarily from what the "in crowd" refers to as "big city ghettos."
3. being easily turned off with the presentation of conventional textbook pages of mathematics which, to them, seems irrevelant, because of too many words, symbols, and diagrams - they are poor readers.

4. being less likely to complete their high school education because of a constant record of failure.

Objectives of the Program

The objectives of this program are to:

1. improve the mathematical concepts of the Under-Achievers.
2. improve the Under-Achievers' skills in problem solving capabilities.
3. change the attitudes of these students towards mathematics (negative to positive)
4. present mathematics as a form of recreation.

Course Content of Stretchers and Shrinkers

This course is divided among four workbooks. They are Book I, "The Theory of Stretching Machines"; Book II, "Advanced Topics in Stretching Machines"; Book III, "The Theory of Fractions" and Book IV, "Decimals".

Stretch and shrink machine models are developed that work on unit measure inputs. Generally speaking, a stretching machine makes the input stick longer and the shrinking machine shortens the input stick. This is an existential generalization rather than a universal one.

These models are used throughout the set of rational numbers to give the students an understanding of fractions, percent, mixed numbers, and decimals through a modern approach.

An "Activities Handbook" accompanies the teacher's edition. This handbook is very vital to the teaching of the course because of its changes of pace, puzzles, and games that "fix" the concepts that are presented in the student workbook.

Implementation Procedures

Administrative - The Chief Mathematics Administrator must become interested in the philosophy, objectives, and the approaches of the Stretcher - Shrinker program. Consultations are then in order with Dr. Beberman and the parties concerned. If the terms are agreeable, Dr. Beberman will write a proposal for the project which may be accepted or rejected by the NSF. Of course the local board of education must approve the project.

Teacher in-service training - The teachers who are selected for the program generally agree to attend the NSF Summer Institute which is held at the University of Illinois, Urbana - Champaign for a period of six weeks during the summer. They then return to their home schools to teach the course(s).

Evaluating the Program

The Office of Research and Evaluation, the School District of Philadelphia, will evaluate the program during the spring of 1970. The Iowa Test of Basic Skills and a Semantic Differential Aptitudinal Test, which was proposed by the classroom teachers and developed by Research and Evaluation, will be used.

For our behavioral goals, we want to show an increase in the students' arithmetic concepts and problem solving capabilities in addition to bringing about attitudinal changes in mathematics.

As to our program goals, we want to improve the mathematics achievements of our under-achieving students. (Levels of Under-Achieving students are operationally defined as 0 - 1.0 years below grade level; 1.1 to 2.5 years below; and 2.6 years or more below grade level in mathematics.)

Since our high schools do not use the ITBS as their testing instrument, a descriptive evaluation will be made of these students' progress.

Recommendations to School Systems that Wish to Install a Similar Program

In addition to the administrative and teacher training considerations, much throught should be given to the equipment and supply items, since this course depends upon nonverbal presentations i.e. cartooned stories, pictorial displays of information and the like.

Each teacher should have access to an overhead projector daily and a heat transmission device (for making spiric masters) occasionally. Of course, a spirit duplicating machine is a must. In addition, each teacher should have the following supplies for each class:

3 each . . . . . boxes of transparencies
8 reams . . . . . bond paper
3 boxes . . . . . spirit masters (thermal)
3 packages . . . 3 x 5 cards
4 each . . . . . pens for transparencies

Why don't we all join hands to help the Under-Achiever? I'm ready. Are you?

THE PHILADELPHIA - UNIVERSITY OF ILLINOIS COMMITTEE ON SCHOOL MATHEMATICS COOPERATIVE PROGRAM FOR UNDER-ACHIEVERS --STRETCHERS AND SHRINKERS--

Summary from Small Group Sessions of Characteristics which seem to Contribute to the Success of this Program.

Personnel

The teachers are all well trained by the UICSM staff. The availability of a supervisor, free to assist teachers with problem areas, is also an asset.

Materials

The student materials consist of a self-contained package developed by UICSM, supplemented by Madison Project materials and other manipulative devices and aides.

The teacher's Activities Guide is considered to be a necessary adjunct to the program.

Student Activities

The participatory nature of the student materials, together with the supplementary manipulative activities, constitute the core of the program.

Planning and Evaluation

The planning was careful and complete. Both pre-service and in-service education was provided and staff commitment secured.

Evaluation, though subjective at this point, is most positive.

Administration

We refer to Mr. Sloan's recommendations on page 2 of his report. These are definitive.

Other

The financial commitment to the program by the district also contributed to the success of the program. The cost of materials necessary to the program is $10 per student.

TOTAL MATHEMATICS EXPERIENCE PROGRAM

Dale R. Rapp
Washington Junior High School
Duluth, Minnesota

This program is an attempt at not only having students learn the mathematics that they must know in order to take their place in our society, but it is also an attempt at making this learning experience as enjoyable as possible. This program rejects the concept of Seventh, Eighth and Ninth Grade General Mathematics, Algebra and Geometry as separate concise courses. In their places a new course, "Junior High School Mathematics," is substituted as a course that does not have well defined initial or terminal points. As a total experience program, each student is considered as an individual with individual differences and abilities. To accomplish this the concepts of "Individualized Instruction" have been embraced. We are trying to identify what must be learned by each individual pupil, instead of what has been traditionally taught to every student. We are trying to find new and possibly better methods of helping these students learn.

Games, blocks and calculators are some of the items used in the dual role of educational tool and motivational device. It is through the use of this type of material along with the change in curriculum that evolved through the individualization of our program that has motivated many previously unmotivated students. The individualization of instruction enables the students to proceed at their own pace while the games and blocks provide the motivation to proceed and the reward for proceeding.

Our program is directed at all of our junior high math students with little regard to their special abilities or achievement. Special emphasis is placed on the low achiever only because of the nature of individualized instruction which allows the teacher some of the additional time needed to work with these students. Washington Junior High is a three year junior high school embracing what is commonly thought of as grades seven, eight and nine. It is for this range of student that the program has been designed. In our present program we have pupils with I.Q.'s varying from the 60's to the 140's and we do include about fifteen

"Educable Mentally Retarded" students.

Duluth, Minnesota is a very stable community of slightly over 100,000 people with a school system having a population of about 25,000 students and 1,000 teachers. Washington Junior is Duluth's downtown junior high and its 1500 students come from all levels of the social-economic strata. In relationship to the other junior high schools in the city, Washington Junior does have a greater percentage of the pupils that are classified as educationally and/or socially deprived.

Our present mathematics program began three years ago when our school decided to experiment with individualized instruction as did other selected schools in our system. In the first year the math program involved one teacher and 150 seventh grade students. The following year, three teachers, 300 seventh grade and 150 eighth grade students took part in the new math program. This year, nearly all the pupils in our school are involved in this experiment along with seven teachers. The entire program is a never ending evolution incorporating increasingly more ideas and methods proportionately as money, materials, experience and knowledge become available. In the initial year, 450 hours of in-service time was allowed for each involved teacher. During the following two years, decreasing amounts of in-service time was made available to new teachers in the project, not because less time was needed, but because the project is primarily federally funded and the additional funds for expansion were not available. In addition to the in-service time, money for materials and classroom furniture was made available in amounts varying from 300 dollars to 1000 dollars depending on the number of classrooms involved.

Evaluation instruments have not yet been devised that can accurately measure what is being done in many schools throughout the United States. Present instruments, at best, are based on the present traditional curriculum from which they evolved many years ago. For this reason, to speak of great success or failure in any progressive imaginative program may be considered educational folly. We have attempted to evaluate our progress by traditional methods comparing our program to the traditional classroom. At Washington Junior, instead of pointing with pride at what might be considered great success, we would rather study the results and question what they prove. We would have been happy if the results had only shown we were doing no worse than the traditional has done.

It would be highly recommended by any teacher or administrator in Duluth's project schools that to begin any new project such as we have done, that a minimum of 450 hours of in-service time be made available to each participating staff member. It would also be suggested that those who participated in such a program do so because they feel that all methods they now use are not correct and there must be a better way. In this manner they then volunteer for such an assignment.

TOTAL MATHEMATICS EXPERIENCE PROGRAM

Summary from Small Group Sessions of Characteristics which seem to Contribute to the Success of this Program.

Personnel

Teachers in the project are all volunteers and are assisted by teacher aides, student cadets and student teachers. It would seem that some type of paraprofessional help is essential. The project also benefits from the availability and cooperation of the school counselors.

Materials

The student works under a "contract" arrangement. Work sheets are prepared by the teachers and are available as needed by the students. The project makes use of motivational games, references, and other resource materials. These are all coordinated with the instructional objectives. The project works from a multi-text base and a large variety of texts are available.

Student Activities

The student achieves his goals by completing a contract. In doing this, he is free to work independently or in small groups. The total program is student centered; thus exhibiting flexibility regarding time allocations for completing a topic or covering a certain concept.

Planning and Evaluation

An impressive amount of time and expense was devoted to in-service education and the development and preparation of materials for both student and teacher use. A plan for evaluation of the project has been conceived and is to be administered by an outside agency. A continuous student evaluation program is in effect.

Administration

The program has been given total support by the local administration. The director has freedom in implementing the program, including budget determination. These factors are further strengthened by the existing conditions which provide for the director to be located in the school, teach classes, and thus remain quite close to the program.

Other

It should be noted that the program includes the total range of student ability. The program also benefits from the proximity of a university, thus providing the school with student teachers.

COMPUTER ASSISTED INSTRUCTION: SOME PRACTICAL CONSIDERATIONS[1]

Ronald Carruth
Director of CAI
McComb Public Schools
McComb, Mississippi

Presented by: J. D. Prince
Superintendent
McComb Public Schools
McComb, Mississippi

Is CAI Valuable As An Instructional Tool?

Computer-Assisted Instruction (CAI), the use of the computer to assist both teacher and pupil in the instructional process, is an instructional technique which should be given definite consideration for use in today's schools.

Past prophecy by proponents of CAI has indicated their belief that CAI can make possible the realization of the age-old goal of individualization of instruction.

During the past two or three years, CAI drill-and-practice systems have become operative in several school districts such as New York City; Palo Alto, California; Waterford, Michigan; and McComb, Mississippi. From these sources reports are evolving which indicate that CAI does make a significant difference in the achievement of pupils.

Is It Ready for General Educational Use?

The practical and immediate problem preventing clear decision making regarding CAI as an educational tool may well be influenced by those past references to CAI's ability to "meet individual differences." The conclusion is too often drawn that CAI meets individual needs of all pupils equally well and, as a consequence, must be provided to all pupils. The problem is further confounded by continuing pressure for development of additional curricula for CAI instructional systems. The implication of these generalizations is that a computer large enough to serve all pupils at any particular grade level in a school district is required before CAI can become a viable system.

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[1]Prepared for delivery to the American Association of State Supervisors of Mathematics, Charlottesville, Virginia, December 8, 1969.

To avoid such misconceptions, those in the decision making role as to whether CAI should be used in a particular setting need discriminant and parametric data from operating CAI programs as to which groups of pupils best profit from drill-and-practice systems and why. Cost effectiveness studies of CAI systems require more detailed data on the effect of CAI. Practical administrative considerations (such as would be made by a board of trustees) demand predictive data which will allow some form of selective provision of drill-and-practice systems to pupils who will profit substantially from CAI. Otherwise, CAI will prove disappointing to those who take a "blue sky" viewpoint as to the efficacy of this practical instrucational technique.

Drill-and-practice CAI systems offer the opportunity to provide individualized drill for skill subjects, which make up a substantial part of the elementary program. Drill-and-practice CAI curricula (and relatively inexpensive computer hardware to deliver the program to the child) are now available in elementary arithmetic and English. Such programs are designed only as a supplement to classroom instruction. However, they do provide the potential for strengthening vital skill areas for elementary pupils, while eliminating the waste time of rote-type teacher duties while providing daily information on pupil performance in the acquisition of skills.

This type of CAI program has particular relevance to current needs in providing instruction for the disadvantaged child. Gaps in achievement between populations of the disadvantaged, which are presently hampering the traditional educational program, and other children can be narrowed, although the technique may not prove of value in all individual cases.

Where Do I Start?

The fact that the school administrator must find some beginning point for the implementation of CAI in a school district should in no way imply that his viewpoint or his interest is limited to drill-and-practice CAI systems. More advanced tutorial systems, on-line to larger computers, for elementary and secondary schools in many curriculum areas obviously demand, and will get, serious attention as computer science develops greater complexity.

From a practical administrative standpoint, a proposal to a local school board today for the purchase and implementation of a CAI system must meet the following criteria:

1. Meet a current and apparent need in the educational program.
2. Serve a substantial portion of the pupil enrollment at a particular level of the school program, based on individual pupil needs.
3. Provide a reasonable cost-effective system, based on the per pupil cost of pupils served by the system.

Some Specific Recommendations

In our opinion, such requirements as specified above appear to be substantially met at the present time by a drill-and-practice CAI curriculum in basic arithmetic or English. The program, however, should be made available only to those groups of pupils who profit substantially, as indicated by previous research.

From technical and cost standpoints, the hardware system should be composed of small digital computers (4-8 K) which provide daily drills to pupils on a simple terminal, such as the ASR-33 teletype terminal. The results of daily pupil performance in this satellite system should be batch processed on a larger computer and drills for the subsequent day produced for return to the satellite systems. In school systems which have available time on a data processing computer for administrative services, the small computers and the terminals would constitute the main hardware costs.

Eliminating daily communication costs is a must for efficient financial operation. Where possible, all terminals should be hard-wired to the computer thus avoiding major communication costs.

The efficiency of a CAI operation can also be enhanced in other ways. The terminals should be located in terminal rooms, not in the classroom, for full pupil utilization and ease of maintenance.

The use of para-professional CAI Aides also pays dividends in each of the terminal locations. These aides insure efficiency in terminal use time and can be easily trained to attend to minor mechanical adjustments.

The position of a CAI Supervisor is also essential if proper communication between the instructional and technical personnel is to be maintained. The supervisor can follow up daily reports on pupil CAI performance with classroom teachers and technical personnel to determine where adjustments in instructional, organizational and technical strategies are needed.

Additional cost savings can be effected in school districts where it is possible to locally perform maintenance on computers and terminals. The technical success of the McComb program 's in large part due to the capability of a locally trained technician.

In the final analysis, a CAI system as outlined above will never provide an answer to the interests or the needs of all educators. Yet for school administrators making decisions today, such a system appears to be the most practical and feasible approach to initial CAI implementation.

MEMORANDUM

To: J. D. Prince

From: Dr. Barr Healy

Date: December 4, 1969

Subject: Quality Education: A Proposal for New Dimensions in Mississippi Public School Education using Computer Assisted Instruction

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At present, the quality of education depends in large measure upon the training, skill and enthusiasm of the teacher. Where one or more elements of these teacher competencies is lacking, some substitute is best found. Not surprisingly, Computer Assisted Instruction (CAI) can replace human skills to a certain extent in a machine-intensive educational environment.

In grades 4, 5 and 6, curricula are available which can be taught by the computer. These curricula deal with pupil skill development in English and arithmetic. Approximately one-half hour per day at the present time can be very profitably occupied by a student in the CAI environment.

In order to maximize any economies resulting from a machine-intensive educational environment, supervisory labor should be reduced. This can be done by assembling class-size groupings of terminals in a large room. One aide can feasibly monitor 30 students working on the CAI curricula. In such an environment, an aide will cost approximately 8 cents per student hour. For a similar grouping in an ordinary classroom, a teacher in Mississippi will cost from 18 to 25 cents per student hour. (Average salary $6,000 ÷ 30 students ÷ (180 days x 6 hours/day) = $.18/student/hour.) A difference of from 10 to 17 cents per student hour results. This balance can be applied to defray in part the costs which are associated with the quality education provided by CAI.

The most direct means of achieving this savings is to schedule the day in one-half hour segments and release one class of thirty students into the care of the aide while the teacher teaches a different group of students, has lunch, preparation period, etc. In the school budget, the savings will appear as the reduction of one teacher's salary per 30 CAI terminals.

Naturally, each school district will have practices which will make reliance on this scheduling technique less than attractive at first glance. However, the educational advantages accruing from eliminating less competent personnel and providing a reliable medium for instructional improvement far outweigh scheduling convenience.

COST ANALYSIS OF A CAI SYSTEM IN MISSISSIPPI

I. Operating parameters based on current technical data available from McComb Schools Project

- 6 year life of computer equipment
- 4 year life of teletypes
- 10 percent value remaining after equipment life
- 9 month school year
- 6 hour instructional day
- In-house updating @ $30
- Maintenance local @ $400/system/month
- No communications costs
- 6 year capital outlay
- Purchase of equipment

II. Cost per pupil hour with various hardware configurations

30 Terminal Cluster

Computer	$ .287
Teletypes	.124
Updating	.051
Maintenance	.099
	.561
less residual value	.041
Cost/Student/Hour	$0.520

64 Terminal Cluster

Computer	$ .202
Teletypes	.124
Updating	.040
Maintenance	.075
	$ .441
less residual value	.033
Cost/Student/Hour	$0.408

96 Terminal Cluster

Computer	$ .162
Teletypes	.124
Updating	.035
Maintenance	.060
	$ .381
less residual value	.029
Total Cost/Student/Hour	$ .352

128 Terminal Cluster

Computer	$ .147
Teletypes	.124
Updating	.030
Maintenance	.050
	$ .351
less residual value	.027
Total Cost/Student/Hour	$ .324

III. Actual costs to the school districts are then the result of

CAI costs/student/hour - teacher cost savings (av.)

30 Terminal System	$ 0.520
	- 0.170
	$ 0.350
64 Terminal Cluster	$ 0.408
	- 0.170
	$ 0.238
96 Terminal Cluster	$ 0.352
	- 0.170
	$ 0.182
128 Terminal Cluster	$ 0.324
	- 0.170
	$ 0.154

It will be noted that in order to make these costs work out in practice, large numbers of terminals should be concentrated in one place. Thus, in order to maximize economies, more grade levels and more terminal time should be planned.

To achieve this, some curriculum changes must be included. On a state-wide basis, a charge per hour of $0.02 would be more than adequate to permit extensive curriculum development in a non-profit environment. $0.02 will provide a development fund of around $40,000/year. I would estimate that a spelling program could be developed for several grade levels for this sum in 6 months working time.

No allowance has been made in the above figures for increasing teacher costs. This increase has over the past ten years been far more than cost of living and can be expected to accelerate in its rate of increase.

The following schedule represents best estimates of actual costs to the school district for CAI, including curriculum changes on a per pupil per hour basis:

Terminals	Size of School	Hours of CAI/Day	CAI Cost/ Student/Hr.	Actual CAI Cost Per Yr.	Net CAI Cost/Pupil Per Year	Net Cost of CAI Per Year
	180 pupils	½	$	$	$	$
30	360 "	½	0.37	46.80	33.30	11,988.00
64	768 "	½	0.26	36.72	23.40	17,971.00
96	1152 "	½	0.20	31.68	18.00	20,730.00
128	1532 "	½	0.17	29.16	15.30	23,439.60

IV. Conclusions

At the present time in the State of Mississippi, there are many elementary schools with populations in excess of 540 students. Thus an effective cost of $0.15 to $0.25 per student hour will be able to reach most of the students under consideration, if the entire grade spectrum is covered by CAI.

The effect of the above calculations is to show that CAI -- if funded over 6 years and used to improve teacher quality -- will cost one-tenth of tentative figures now being studied.

JRP:el

COMPUTER ASSISTED INSTRUCTION: SOME PRACTICAL CONSIDERATIONS

Summary from Small Group Sessions of Characteristics which seem to Contribute to the Success of this Program.

Personnel

It would appear that a key factor is a strong director and total administrative support. In the case of this project, provision for this factor appears to be exceptionally good. The teachers need only a modest amount of in-service training in content and terminal/computer use. The presence of teacher aides for clerical, housekeeping and monitoring duties is desirable. Finally, the availability of technicians for equipment maintenance seems necessary.

Materials

The materials are of two types: hardware and software.

The "software" consists of the Suppes drill and practice materials and are judged to be superior. In addition, the McComb project has developed the ability to revise these materials to suit its particular needs.

The hardware has been chosen after careful study and has proved highly reliable.

Student Activities

Each student "communicates" regularly with the computer. The sessions are brief, fun, and motivational. The operation of the terminal is easy and provides for student involvement. No more than half-hour sessions at the terminal are recommended. The drill and practice are supplementary to the regular instructional program. Immediate reinforcement is provided and all performance records are stored in data bank for quick retrieval.

It would appear that disadvantaged students benefit more from the experience than do other students.

Planning and Evaluation

The planning was complete and thorough. USOE funds were used initially. The district has now assumed the cost as a result of the demonstrated results of the project. Planning continues to guarantee the greatest return for the monies invested.

The evaluation has been as thorough and valid as the planning. The research connected with the evaluation has been done by diverse laboratories and individuals.

Both the planning and evaluation of this project are deserving of imitation.

Administration

The project shows a research oriented program with strong administrative support. Thus, the school district has become totally committed. The project benefits from a capable CAI director and strong financial management.

Other

The project has used the Stanford Logic program for the better students. The project has also investigated the possibility of rental of hardware use to help support cost of the program.

INSTRUCTIONAL PROGRAMS IN MATHEMATICS FOR CHILDREN IN SUBCULTURAL POPULATIONS

E. Glenadine Gibb
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Introduction

The Mathematics Education Program of the Southwest Educational Development Laboratory is directed toward economically disadvantaged and culturally different children who have been experiencing continued failure and discouragement in mathematics. More specifically, the project has addressed itself to the following questions:

1. Why are children in the target populations failing in mathematics?
   a. Is it the nature of the present-day curricula which otherwise seems to be effective for more economically advantaged children and for children primarily from the Anglo culture?
   b. Do teaching procedures designed for present day curricula fail when used with children in the target population?
   c. Do children from different cultures and economic levels learn differently than do those children for whom present-day curricula are said to be designed?
2. What changes made in the curricula and in teaching procedures can effect positive learning of mathematics on the part of children from the target populations?
3. How can we help teachers and local curriculum specialists to adapt and modify their school programs to meet the needs of children in the target populations under consideration?

Based on the assumption that there are cultural variations which are important in providing an effective mathematics program for the economically disadvantaged as well as the culturally different, the project is striving to attain the objectives as stated in the following section.

Prepared for the Conference for State Mathematics Supervisors on Programs in Mathematics for Low Achievers, December 4-9, 1969, held at the University of Virginia, Charlottesville, Virginia.

Objectives

1. To identify areas of understanding and skill where a positive emphasis on background may be a basic contributing factor to successful learning;
2. To adapt otherwise successful materials and develop mathematics programs (content, methods, aids) in the elementary schools so that they take full cognizance of the particular cultures of children;
3. To develop teacher education programs (both in-service and pre-service) which prepare more teachers to teach mathematics more effectively to children from the target populations;
4. To evaluate the effectiveness of adapted and modified programs as compared with programs currently used, both for the students and for their teachers; and
5. To provide a rapid means of disseminating information to school personnel (teachers, consultants, administrators) concerned with teaching disadvantaged children.

Procedures

1. Samples of The Target Populations and Components of the Program
   a. Adapted and modified curricula based materials produced by the Educational Development Center and the School Mathematics Study Group.
      (1) Low economic Mexican American students (Grades 1, 2, 3, 4, 5, 7)
          6 classes at each grade level in one school system
      (2) Low economic black and Anglo students (Grades 1, 2, 3, 4, 5, 6, 7, 8)
          6 classes at each grade level in one school system
   b. Supplementary Mathematics Program, where materials developed to supplement current, state-adopted textbooks
      Migrant Mexican American Students (Grades 1, 2, 3)
      One to 3 classes at each grade level in two schools
   c. Individually Prescribed Instruction Mathematics Program
      Migrant Mexican American students (Grades 1, 2, 3, 4, 5, 6 and Remedial 7, 8, and 9)
      One class at each grade level in primary, intermediate and junior high school respectively.
2. Background Studies

   Two studies have been made for the purpose of identifying the sociological and psychological factors related to the acquisition of mathematical understandings and skills on the part of (1) Mexican Americans, stratified

into three generation levels and in grades 1, 3, 6, 7, 9, 10, 11, and 12; and (2) black and Anglo students from low socio-economic level and in grades 2, 4, and 7.

3. Implementation

Materials have been adapted and modified by summer writing groups and by full-time laboratory professional staff. The implementation and evaluation of the effectiveness of the modified materials are under the direction of professional site curriculum specialists in the two major sites (one for Mexican American populations and one for black and Anglo populations). Other apsects of the project are under the direction of staff members in the central office and in cooperation with a regional service center.

Preliminary adapted materials for grades 2, 4, and 7 were design tested during 1968-69 and revised during the summer of 1969. Preliminary adapted materials for grades 2, 4, and 7 were design tested during 1968-69 and revised during the summer of 1969. Preliminary adapted materials for grades 1, 3, 5 and 8 were prepared during the summer of 1969 and are presently being design tested. Revised materials for grades 2, 4, and 7 are also being tested at the present time.

Unit evaluations, observations, teacher comments, and summative evaluations are procedures being used to assess the effectiveness of the modifications and adaptations.

Installation

It is premature to consider the installation of a program (or programs) which we are presently conceptualizing. During the present year an all-out effort is being made to refine the materials, based on design testing and evaluation, so that a program might be extensively field tested during the academic year, 1970-71. Until the components of the package are clearly identified as a result of the analyses of the three explorations presently being undertaken, recommendations for installation, administrative needs, and costs cannot be given at this time.

INSTRUCTIONAL PROGRAMS IN MATHEMATICS FOR CHILDREN IN SUBCULTURAL POPULATIONS

Summary from Small Group Sessions of Characteristics which seem to Contribute to the Success of this Program.

Personnel

Teachers in the project are bilingual. In a few cases, where a bilingual teacher is unavailable, a bilingual paraprofessional is present to assist the teacher.

Materials

Non-commercial materials are used as a basis for the program and adapted to meet the needs of the children. The adaptation tends to minimize the verbal nature of the program. Where language is required, the particular colloquialisms of the area serve and guide the writers.

Student Activities

All activities are planned with three criteria in mind:

1. Make concerted effort to relate the activity to the life experience of the students.
2. Include some activities for motivational purposes.
3. Gear activities to help students overcome their reluctance to participate and to verbalize.

Planning and Evaluation

The planning for the project was based on a thorough study of the needs of the students as gleaned from teachers, parents, and students themselves. As a result, the teacher training phase included study of the culture of the children to be served as well as some work with subject matter.

Evaluation is planned and will be conducted by the Southwestern Educational Development Laboratory.

Administration

No particular factors here.

Other

The teacher in-service training included knowledge of the culture, the home, and the life experiences of students. The training centered around techniques of dealing with language and cultural differences.

The project has recognized the differences between first and second generation Americans.

CONCLUSIONS

Any school district developing mathematics programs for the underachiever or planning to replicate projects described in this publication should consider carefully the following items that appear to be characteristic of successful programs.

Planning Considerations

The district should

carefully assess the needs of students to be served by the project; these should include not only academic but emotional and environmental needs.

develop the project as a pilot program initially; detailed plans for expansion would then be implemented as a result of evidence of successful experiences and as a favorable climate for support is developed.

develop the objectives for the program with particular emphasis on short range goals for students; preferably these goals should be stated in behavioral terms.

provide the means for the incorporation of a variety of activities with built in change of pace experiences in recognition of the short interest span of students, and the utilization of activities that are highly motivational.

Supportive Elements

The district must consider

the financial capacity of the community to support the project and the commitment of the community to sustain it.

the special interest in and the empathy for low achievers on the part of personnel working on the project.

the competency of the leadership within or outside the local district to plan, initiate and evaluate the project.

the availability of competent resource personnel.

the need for strong administrative leadership on the local level to coordinate and oversee the entire project.

the need for trained staff and an appropriate program of in-service training for new staff members as required for the project.

the provision for visitations to related projects by the staff and administration in order to obtain maximum input.

the availability of equipment and supplies needed to carry on the project.

the need for clerical help and paraprofessionals.

Other Activities

The district must provide for

built in, on-going evaluation with provision for feed back and change when the evaluation indicates it.

articulation of the project with the total mathematics curriculum to provide continuity of learning experiences for students.

dissemination of successful practices and positive results to other schools to benefit a wider educational community.

PART IV

PUBLICATION PLANS

As indicated in earlier sections of this report, a follow-up publication is planned. This booklet will be designed as a source book for mathematics consultants in local schools, general curriculum consultants and supervisors, local curriculum committees, school administrators, and any others who may be involved in the development of compensatory mathematics programs.

It is expected to contain descriptions of characteristics that are felt to be essential to the success of such efforts. These descriptions will be developed from the output of the small group sessions held during the conference. In addition it will include a State by State listing of resource people who may be available for consultation on compensatory programs. The conference participants and their colleagues were also asked to supply a listing and brief description of programs and projects in their respective States that they would recommend as models for possible adaptation and/or adoption in other schools. This listing will be included. Noncommercial materials produced by some of these projects or individuals will also be listed.

The program committee was charged with the responsibility for developing such a booklet during a two day post conference session. Although the source and resources for publication have not yet been determined, it is hoped that it will be widely available to those who may find it helpful.

A P P E N D I C E S

APPENDIX A

PARTICIPANTS, OBSERVERS, SPEAKERS

CONFERENCE OF STATE SUPERVISORS OF MATHEMATICS ON PROGRAMS IN MATHEMATICS FOR LOW ACHIEVERS

Supported by

The University of Virginia, The National Science Foundation, and the U. S. Office of Education

University of Virginia
Charlottesville, Virginia
December 4-9, 1969

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APPENDIX B

CONFERENCE OF STATE SUPERVISORS OF MATHEMATICS
ON PROGRAMS IN MATHEMATICS FOR LOW ACHIEVERS

University of Virginia

Supported by
The National Science Foundation
and
The U. S. Office of Education

Howard Johnson Motor Lodge
Charlottesville, Virginia
December 4-9, 1969

PROGRAM

Thursday, December 4

3:00 - 5:00 P.M.	REGISTRATION	Mezzanine
5:00 - 6:00 P.M.	PRELIMINARY SESSION	Beta
7:30 - 9:00 P.M.	GENERAL SESSION	Alpha
Presider:	Carl Heilman, Pennsylvania	
Welcome:	Frederick R. Cyphert, Dean, School of Education, University of Virginia	
Announcements:	William C. Lowry, Conference Director, University of Virginia	
Speakers:	C. Russell Phelps, National Science Foundation	
	Dexter A. Magers, U. S. Office of Education	
	Purposes of the Conference	

Friday, December 5

9:00 - 12:15 P.M.	GENERAL SESSION	Alpha
Presider:	Gladys Thomason, Georgia	
9:00 - 10:45		
Speaker:	Florence Segal, Assistant Professor of Social Work, Virginia Commonwealth University	
	Low Income Background and Achievement in School - Are These Incompatible?	
	Questions and Discussion	
10:45	Coffee	
11:15 - 12:15		
Reactors:	Glyn Sharpe, Colorado	
	Edgar L. Edwards, Virginia	
	William B. Hynds, South Carolina	

1:30 - 3:00 P.M.	GENERAL SESSION	Alpha
Presider:	Glyn Sharpe, Colorado	
Speaker:	Terry Shoemaker, Castle Rock, Colorado	
	The COLAMDA Project (Committee on Low Achievers in Mathematics - Denver Area)	
	Questions and Discussion	
3:00	Coffee	
3:30 - 5:00 P.M.	SMALL GROUPS SESSION	
	Analysis of Features of the COLAMDA Project	
Leader:	Arthur J. McMahon, Rhode Island	Alpha
Recorder:	Clare Nesmith, Georgia	
Leader:	Thomas N. McCreary, Pennsylvania	Beta
Recorder:	Dexter Magers, U.S.O.E.	
Leader:	Lee Von Kuster, Montana	Gamma
Recorder:	Cleo M. Meek, North Carolina	
Leader:	Elizabeth M. Glass, Connecticut	Delta
Recorder:	Roland G. Long, Illinois	
7:30 - 9:00 P.M.	GENERAL SESSION	Alpha
Presider:	Isabelle P. Rucker, Virginia	
Speaker:	Alan Barson, Resident Coordinator of the Madison Project for the City of Philadelphia	
	Training Teachers to Work With Low Achievers	

Saturday, December 6

9:00 - 12:15 P.M.	GENERAL SESSION	Alpha
Presider:	Veryl Schult, U. S. Office of Education	
9:00 - 10:45		
Speaker:	Vincent Brant, Coordinator of Mathematics, Baltimore County, Maryland	
	Behavioral Objectives and the Slow Learner - An Action Approach	
	Questions and Discussion	
10:45	Coffee	
11:15 - 12:15		
Reactors:	Thomas Rowan, Maryland	
	Bessie Frank, California	
	George Henderson, Wisconsin	

1:30 - 3:00 P.M.	GENERAL SESSION	Alpha
Presider:	Elden Egbers, Washington	
Speaker:	Leonard Sloan, Project Coordinator	
	UICSM Philadelphia Under Achiever Project	
	Questions and Discussion	
3:00	Coffee	
3:30 - 5:00 P.M.	SMALL GROUPS SESSION	
	Analysis of Features of the UICSM Program	
Leader:	William B. Hynds, South Carolina	Alpha
Recorder:	Bessie Frank, California	
Leader:	Vincent Acquaviva, New Jersey	Beta
Recorder:	Isabelle P. Rucker, Virginia	
Leader:	Fernand Prevost, New Hampshire	Gamma
Recorder:	Renee Henry, Florida	
Leader:	Ralph Mahan, Delaware	Delta
Recorder:	Eldon Egbers, Washington	

Sunday, December 7

1:30 - 3:00 P.M.	GENERAL SESSION	Alpha
Presider:	Elizabeth M. Glass, Connecticut	
Speaker:	Dale Rapp, Duluth City Schools	
	The Total Mathematics Experiences for Low Achievers Program	
	Questions and Discussion	
3:00	Coffee	
3:30 - 5:00 P.M.	SMALL GROUPS SESSION	
	Analysis of Features of the Total Mathematics Experiences Program	
Leader:	Fernand Prevost, New Hampshire	Alpha
Recorder:	Carl Beisecker, Arizona	
Leader:	John Ogle, North Carolina	Beta
Recorder:	Elizabeth M. Glass, Connecticut	
Leader:	Isabelle P. Rucker, Virginia	Gamma
Recorder:	John Steele, Ohio	
Leader:	George Henderson, Wisconsin	Delta
Recorder:	Gladys Thomason, Georgia	

Monday, December 8

9:00 - 10:30 P.M.	GENERAL SESSION	Alpha
Presider:	Fernand Prevost, New Hampshire	
Speaker:	J. D. Prince, Superintendent of Schools, McComb, Mississippi	
	The Drill and Practice CAI Program	
	Questions and Discussion	
10:30	Coffee	
11:00 - 12:30	SMALL GROUPS SESSION	
	Analysis of Features of CAI Program	
Leader:	Truett Goatcher, Arkansas	Alpha
Recorder:	Fernand Prevost, New Hampshire	
Leader:	Glyn Sharpe, Colorado	Beta
Recorder:	Ron Gutzman, Nevada	
Leader:	Thomas Rowan, Maryland	Gamma
Recorder:	John Sullivan, New York	
Leader:	Daniel H. Sandel, South Carolina	Delta
Recorder:	Lloyd Crook, Alabama	
1:30 - 3:00 P.M.	GENERAL SESSION	Alpha
Presider:	Leila Stalker, Virginia	
Speaker:	E. Glenadine Gibb, University of Texas at Austin	
	Teaching Matheamtics in English to Bilingual Pupils	
	Questions and Discussion	
3:00	Coffee	
3:00 - 5:00 P.M.	SMALL GROUP SESSION	
	Analysis of Features of the Project for Bilingual Pupils	
Leader:	James Oakes, Tennessee	Alpha
Recorder:	Renee Henry, Florida	
Leader:	Elden Egbers, Washington	Beta
Recorder:	Glyn Sharpe, Colorado	
Leader:	Edgar L. Edwards, Virginia	Gamma
Recorder:	Don Rasmussen, Oregon	
Leader:	David Dye, Minnesota	Delta
Recorder:	Alice Kidd, Texas	
7:30 P.M.	ASSM MEETING	Alpha

Tuesday, December 9

9:00 - 12:00 Noon	GENERAL SESSION	Alpha
Presider:	Dexter Magers, U. S. Office of Education	
9:00	Conference Evaluation and Summary	
10:00	Coffee	
10:30	Reactions to Summary	
1:30 P.M.	Departure	Omega

APPENDIX C

QUESTIONNAIRE

Information gathered from each State via this document will be included in a publication which we expect will be distributed nationally.

For the purposes of this document and the subsequent conference, we are using the following definitions:

(1) Underachiever - one whose achievement is more than one-half of a standard deviation below expectations based on ability measures. This includes, but is not limited to, lack of achievement caused by economic or cultural conditions.

(2) Compensatory program - an instructional program designed to ameliorate under achievement as defined above.

Model Compensatory Programs

This listing should include those programs that you would recommend to administrators and supervisors as models for possible adoption and/or adaptation in their own schools. Any program listed should also meet the following criteria:

(1) Objective data should be available to substantiate its effectiveness.

(2) It should be replicable in other schools. It should not depend on the unique talents of an individual.

(3) It should not be prohibitively expensive.

Noncommercial Materials

This listing should include noncommercial materials, produced by projects or individuals, that have been used and found to be effective in compensatory mathematics programs. Books, booklets, worksheets, laboratory devices, films, filmstrips, TV tapes, and other audiovisual or printed instructional materials should be listed. Include cost information, if possible.

Reproduce or add additional sheets as needed. Return to:

Dexter A. Magers
U. S. Office of Education
400 Maryland Avenue, S. W.
Washington, D. C. 20202

STATE ____________________

RESOURCE PERSONS

1. State Education Agency personnel available for expert assistance in establishing compensatory mathematics programs:

NAME	ADDRESS
____________________	______________________________
____________________	______________________________
____________________	______________________________
____________________	______________________________
____________________	______________________________

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2. University, local district, or other personnel who might be available for expert consultation on compensatory mathematics programs:

NAME	ADDRESS
____________________	______________________________
____________________	______________________________
____________________	______________________________
____________________	______________________________
____________________	______________________________

MODEL COMPENSATORY PROGRAMS STATE ____________________

TITLE (If any) ____

____

GRADE OR AGE SPAN ____

SCHOOL ____

CONTACT PERSON ____

ADDRESS ____

_________________________________ PHONE: __________________

BRIEF DESCRIPTION ____

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LIST OF MODEL COMPENSATORY PROGRAMS

ALABAMA

Title: Mathematics Laboratory for Low Achievers

Level: Junior High School

School: Westlawn Junior High School

Contact Person: Mr. Bill Dykes
4217 19th Avenue, Huntsville, Alabama 35805 536-9683

Description: Measuring devices, adding machines, charts, maps, solid and plane figures, calculators. Students are given pre-test to determine basic skills mastered. Students are given activity cards (lab project) related to needed skill development. Most projects can be completed in one class period. This gives students a feeling of success each day.

Title: None specified

Level: 9-12 grades. General Mathematics

School: Butler High School

Contact Person: Mr. Daniel J. Shippy
Box 128, Huntsville, Alabama 35805 539-9486

Description: The program is built around use of calculators as aids for student motivation.
The program has proved most successful in the one year of operation.

ARKANSAS

Title: Calculators in a General Mathematics Laboratory

Level: Grade 9

School: Wynne High School

Contact Person. Mr. Gene Catterton
Wynne Public Schools, Wynne, Arkansas 72396 501/238-2558

Description: A program designed for the low achieving ninth grade mathematics student that makes use of calculators as well as other materials.

CALIFORNIA

Title: Mathematics Specialist Project, Miller Mathematics Improvement Programs (State funded)

Level: Grades 2, 3, 5, and 6

CALIFORNIA - Continued

School: 231 classrooms in nineteen school districts

Contact Person: Leonard M. Warren, Special Consultant in Mathematics
California State Department of Education
721 Capitol Mall
Sacramento, California 95814 916/445-5361

Description: Well-trained mathematicians (including candidates for advanced degrees, college and university faculty members, and persons from industry) provide supplementary instruction in algebra and coordinate geometry to elementary school pupils. Each class meets with a specialist for 40 minutes, four times per week. (See Project S.E.E.D.)

Title: Graduate Community Teaching Fellowship Program

Level: K-6

School: University of California Campuses

Contact Person: Robert Mattison, Director CTF
Lincoln Elementary School
1731 Prince Street
Berkeley, California 94703 415/642-7069

Description: Fellowships are awarded to candidates for doctoral degrees in mathematics to teach abstract mathematical concepts to disadvantaged elementary school pupils. The student is paid by the University (as is a teaching or research assistant) for service in a neighboring school district.
(See Project S.E.E.D.)

Title: Project S.E.E.D. (Special Elementary Education for the Disadvantaged)

Level: K-9

School: Berkeley, Oakland, Del Paso, Richmond

Contact Person: William F. Johntz, Director, Project S.E.E.D.
1011 Keith Avenue
Berkeley, California 94708 415/526-4865

Description: Project S.E.E.D. served as model for the Mathematics Specialist and Community Teaching Fellowship Projects. Abstract mathematical concepts are used as vehicle to provide disadvantaged pupils with an opportunity to enjoy a success experience in a high-status subject, and as a result, youngsters' concepts toward self and school seem to have improved and skills in other academic areas seem to have increased. NOTE: S.E.E.D. is the model used also for Title 1 projects both demonstration (SB 28) and others, and for Title III projects in various parts of the State.

CALIFORNIA - Continued

Title: Compton Union High School District Demonstration Project

Level: Grades 7 and 8

School: Compton Union High School District

Contact Person: Samuel B. Williams
417 West Alondra Boulevard
Compton, California 90220 213/636-2263

Description: Following the ideas of Bloom's Taxonomy, fifty-four educational objectives were formulated for specific treatment and method of instruction. Students moved from a concrete level of functioning, to comprehension of the concept, its application, analysis, synthesis and finally its evaluation.

Title: Achieving Potentialities - Demonstration Project

Level: Grades 7, 8, and 9

School: Stockton Unified School District

Contact Person: Vernon Broussard
701 North Madison Street
Stockton, California 95202 209/466-3911

Description: with cooperation from local business firms, problem solving techniques were developed. Flow-charting and calculators; field trips to businesses and businessmen's talks and trips to schools; interaction analysis techniques with staff, are used in this project.

Title: EDP^2 (Education to Develop Performance - Electronic Data Processing)

Level: 9th grade (reading and mathematics) potential drop out students

School: San Francisco Unified School District

Contact Person: William Keesey
135 Van Ness Avenue
San Francisco, California 94102 415/863-4680

Description: Electronic data processing was used to provide a "real world" situation for learning. The curriculum, designed by Lockheed Missiles and Space Company, was based on an intertwining of academic and electronic data processing disciplines. Besides EDP activities, the project featured games and simulations, field trips, and intensive parent involvement. Evaluation showed significant gains in arithmetic reasoning.

CALIFORNIA - Continued

Title: LAMP (Language Arts Mathematics Program)

Level: Grades 7 and 8

School: San Francisco Unified School District

Contact Person: Lyle E. Eickert
135 Van Ness Avenue
San Francisco, California 94102 415/863-4680

Description: The project involved a combined reading and mathematics curriculum with team teaching. Mathematics concepts and mathematics language were used as vehicles for teaching reading and communication as well as computation.

Title: Monrovia Demonstration Project

Level: Grades 7 and 8

School: Monrovia Unified School District, Clifton Elementary School

Contact Person: Donald C. Clark
122 Linwood Avenue
Monrovia, California 91016 213/359-5301

Description: Learning center, housed in a portable classroom, stresses mathematical laboratory approach. Students learn by gathering and recording mathematical data from real life situations. They are exposed to a learning climate of multisensory approaches to mathematical concepts. Evaluation showed dramatic favorable results.

Title: Oakland Demonstration Project

Level: Grades 7 and 8

School: Oakland Unified School District

Contact Person: Ross A. Franco
Roosevelt Junior High School, 1926 19th Street
Oakland, California 94606 415/261-8516

Description: Use of a teaching team consisting of regular classroom teacher, three graduate students in mathematics from UC, and promising ninth grade students. Classes met daily for two periods. The team-teaching approach permitted intensive, small group instruction. Significant gains over control groups were made in achievement tests and on attitude scales.

Title: Personalized Mathematics - Mobile Laboratory Demonstration Project

Level: 8th grade

School: Long Beach Unified School District

CALIFORNIA - Continued

Contact Person: Marvin L. Johnson
701 Locust Avenue
Long Beach, California 90813 213/436-9931

Description: A manipulative approach to mathematics instruction made extensive use of calculators, balances and simulated computers during the mobile laboratory lesson. A "tote tray" of manipulative materials was provided for each student. Evaluation through use of Cooperative Arithmetic Test showed significant improvement in achievement by the experimental group.

Title: R-3 (Readiness, Learning Relevance and Reinforcement) Demonstration Project

Level: Grades 8 and 9

School: San Jose Unified School District, assisted by Lockheed Missiles and Space Company, Education Systems

Contact Person: William Doyle
1605 Park Avenue
San Jose, California 95114 408/293-5303

Description: Intensive involvement including trips to remote areas gave pupils opportunities to make practical use of classroom knowledge. The instructional system was a diagnostic prescriptive approach using gaming-simulation techniques to improve reading and mathematics skills. This program was recognized by the USOE as one of the nation's top 20 programs in compensatory education. The evaluation showed that R-3 students made significant gains in achievement and attitudes.

Title: Sacramento City Unified School District (Demonstration Project)

Level: Grades 7, 8, and 9

School: Sacramento City Unified School District

Contact Person: John Mamola
P. O. Box 2271
Sacramento, California 95810 916/444-6060

Description: Program in reading and mathematics was designated to capitalize on the student's interest in television and electronics. Students met daily for four hours with four teachers, two mathematics and two reading and language arts. A complex of three classrooms was arranged into the following units: a dial-a-lesson and classroom center, a library and classroom area, and a material production and electronics control section. The project was designed so that students could proceed at their own speed. Evaluation showed significant gains in arithmetic achievement.

COLORADO

Title: COLAMDA (Colorado Low Achiever Mathematics Denver Area)

Level: Grades 7-12

School: Douglas County (13 Metropolitan Districts)

Contact Person: Terry Shoemaker
Box Q
Castle Rock, Colorado 80104

Description: The project is an operational Title III, ESEA project to develop objectives, materials and teaching strategies for low achievers emphasizing a laboratory approach to teaching mathematics to low achievers.

Title: EPDA Contract #151091

Level: Grades 7-9

School: University of Denver

Contact Person: Dr. Ruth Hoffman, Mathematics Department
University of Denver
Denver, Colorado 753-2012

Description: A project to recruit, train and place returning Peace Corps volunteers as junior high school teachers of mathematics for low achievers in the Denver area. Efforts to improve the mathematics background and certification deficiencies are made.

Title: Depository of Materials for Low Achievers in Mathematics (Mathematics Laboratory)

Level: K - college

School: University of Denver

Contact Persons: Dr. Ruth Hoffman
2010 South Gaylord Way
Denver, Colorado

Mrs. Glyn Sharpe
University of Colorado
Denver, Colorado

Description: A laboratory which includes a depository of equipment and materials for teaching mathematics to low achievers.

CONNECTICUT

Title: Laboratory Approach through Games

Level: 9th Grade

CONNECTICUT - Continued

School: Educational Clinic

Contact Person: John P. Walsh
Mistruxet Avenue
Mystic, Connecticut 536-1802

Description: Clinic situation to get at arithmetic learning disabilities utilizing completely individualized approach through multimedia - tapes, loops, games, books, etc.

Title: Reading and Mathematics Program, Title I

Level: Grades 2, 3, 4, and 5

School: Griswold Elementary School and St. Mary's School

Contact Person: Mary V. Joley
Griswold Elementary School
Jewitt City, Connecticut 576-2480

Description: Small groups instruction in mathematics using individualized instructional materials.

Title: Tutorial Assistance in Reading and Mathematics

Level: Grades 2-6

School: Canton Elementary and Cherry Brook Schools

Contact Person: Richard T. Grimley
Canton Elementary School
Canton, Connecticut 693-8512

Description: Individual tutoring program. Diagnosis of problems through testing. Remediation through individual tutoring and small group situations.

Title: Project Focus

Level: Grade 3

School: New Haven Public Schools

Contact Person: Dr. Griscuolo
New Haven Public Schools
New Haven, Connecticut 562-0151

Description: Provide concerted services of reading, mathematics, and curriculum teachers. Analysis of disabilities and methods and materials for remediation. Foster teaching team approach.

CONNECTICUT - Continued

Title: Focus on Action

Level: Grades 3-6

School: Non-Public Schools in Hartford

Contact Person: Thomas Mulconry
Hartford Board of Education
High Street
Hartford, Connecticut

Description: Development of learning centers stressing a multi-sensory approach to learning through diagnosis and tutorial assistance.

Title: Tutorial Program

Level: Grades 7-9

School: Johnson Junior High School

Contact Person: Mrs. MacDonald
Johnson Junior High School
Stratford, Connecticut 375-5621 Ext. 343

Description: A tutorial laboratory established and manned by helping teacher who work particularly with reading and mathematics.

Title: Continuous Progress

Level: Elementary School

School: Claude Chester School

Contact Person: William Korbe
Coroton, Connecticut 445-7437

Description: Grouping for mathematics according to needs. Continuous progress program.

Title: Project Remodel

Level: Junior High School

School: Plante Junior High School

Contact Person: Gerald Hague
Whiting Lane
West Hartford, Connecticut 233-6497

CONNECTICUT - Continued

Description: A laboratory approach to teaching low achievers at junior high school level via calculators and other tools and devices.

FLORIDA

Title: None specified

Level: Grades 7-9

School: West Tampa Junior High School

Contact Person: Mrs. Andria Troutman
Hillsborough County Schools, 707 East Columbus Drive
Tampa, Florida 33602 813/223-5331

Description: Ninth grade classes use Dr. Foley's booklets just released by Addison-Wesley. Seventh and eighth grade classes use various materials, commercial and homemade, experiments, puzzles, games, etc.

Title: None specified

Level: Grade 7

School: Webb Junior High School

Contact Person: Mrs. Andria Troutman
Hillsborough County Schools, 707 East Columbus Drive
Tampa, Florida 33602 813/223-5331

Description: Activity classroom using supplementary material, concrete models, puzzles, games, etc. Teacher trained in EPDA summer institute and academic year in-service training program for teachers of low achieving students in inner city schools.

Title: Stretchers and Shrinkers and Motion Geometry

Level: Grades 7 and 8

School: Fort Walton High School

Contact Person: Mrs. Faye Tucker
Fort Walton High School
Fort Walton, Florida 904/243-8178

Description: Model program using UICSM developed material.

FLORIDA

Title: None specified

Level: Grades 7 and 8

School: Rockway Junior High School

Contact Person: Mrs. Agnes Rickey, Mathematics Supervisor
Dade County Schools, 1410 N.E. 2nd Avenue
Miami, Florida 33122 305/350-3164

Description: Students are programmed through learning activity packages prepared by the "Center For Self-Instruction" featuring a multi-media approach -- tapes, games, puzzles, filmstrips, etc.

HAWAII

Title: Stretchers and Shrinkers

Level: Grade 7

School: 35

Contact Person: Dr. Max Beberman
1210 West Springfield Street
Urbana, Illinois 61801 217/333-1050

Description: Unconventional and motivational approach to the topic of common fractions and decimals. Students who have been in the program, and have also taken the eighth grade Motion Geometry, have successfully completed the course in first-year algebra.

ILLINOIS

Title: Harlan Pre-Algebra Program

Level: Grade 9

School: Harlan High School

Contact Person: Dorothy S. Strong
1750 East 71st Street
Chicago, Illinois 60649 955-0600

Description: The Harlan Pre-Algebra Program, which includes mathematics laboratory instruction, independent study with diagnosis and remediation, regular mathematics classroom instruction, and regular reading instruction, was designed for under-achieving entering high school freshmen with mathematics deficiencies. Through eight weeks of concentrated innovative experiences, many mathematics deficiencies were corrected. Most students showed measurable progress in both mathematics and reading with most of them eliminating the need for remedial mathematics or reading during their high school careers. The program in a modified form is now being considered for the remedial programs at the junior high school and senior high school levels during the regular school year.

ILLINOIS - Continued

Title: Occupation Oriented Mathematics

Level: 9th grade mainly - same in the 10th grade

School: Havana High School

Contact Person: Miss Jean Ann Hopkins
South McKinley Street
Havana, Illinois 62644 309/543-3337

Description: Mathematics to use in vocational program.

Title: Curriculum Demonstration Program

Level: Grades 7-12

School: Quincy Public School System

Contact Person: Marvin H. Rull
1444 Maine Street
Quincy, Illinois 62301 217/223-8700

Description: To renew and improve basic operations by actually working with and in vocations that will probably by their vocations after graduation. Daily life problems are met and solved that will enable the boy or girl to better encounter when making a living for themselves. A filling station is leased by the school district with two paraprofessional supervisors. A supply story is managed by the students at both the junior and senior high schools. The Vocational Improvement Program is designed primarily for senior high school students who are provided with prevocational training to develop skills in crafts, arts, and retail selling.

KENTUCKY

Title: Mathematics Laboratory

Level: Grades 11 and 12

School: Hopkinsville High School

Contact Person: Mrs. Annabelle Brasher, Mathematics Supervisor
Hopkinsville City Schools
Hopkinsville, Kentucky 502/886-2534

Description: A laboratory setting is planned for under achievers. Equipment, including desk calculators, are being used with practical applications being emphasized. Local businesses are cooperating to provide examples of how mathematics is used.

KENTUCKY

Title: The World of Work

Level: Grade 9

School: Leestown

Contact Person: Mrs. Ruth Ratcliffe, Mathematics Supervisor
Fayette County Schools, 400 Lafayette Parkway
Lexington, Kentucky 40505 606/278-6076

Description: The course is designed around the work ambition of the student. Businesses in the community cooperate with various services and equipment. Advantages are freedom from textbook, de-emphasis on grades, and variety of classroom activities. A number of student teachers and teacher aides make it possible to provide individual help when needed.

Title: Readiness for Mathematics

Level: Immature First Graders - Inter-City children

School: Harrison

Contact Person: Mrs. Ruth Ratcliffe, Mathematics Cupervisor
Fayette County Schools, 400 Lafayette Parkway
Lexington, Kentucky 40505 606/278-6076

Description: This is an effort to provide for disadvantaged children, mathematics experiences which are common to middle class children but that inter-city children miss or are deprived of. Special emphasis is on a comfortable approach with much incidental learning. Children learn rapidly through the use of a wide variety of materials.

LOUISIANA

Title: Resource Center for the Low-Achiever in Mathematics

Level: Grades 7-9

School: Lafayette Parish School Board

Contact Person: Miss Lurnice Begnaud
Lafayette Parish School Board
P. O. Drawer 2158
Lafayette, Louisiana 232-2620

Description: The purpose of the program for low-achievers in junior high mathematics is to research, develop, and demonstrate learning packages which place emphasis on self-motivation and independent study work through such techniques as partially programmed booklets, games, puzzles, simulation, decision making exercises, and audio-visuals. A teacher training program is conducted in which procedures and techniques for effective use of learning packages are discussed. Dissimination of packages and new evaluations for modification and strengthening of learning packages are presently being conducted.

MARYLAND

Title: Mathematics for Basic Education

Level: Grade 6 and Grade 11

School: Baltimore County Schools

Contact Person: Mr. Vincent Brant
6901 North Charles Street
Towson, Maryland 21204 825-7200

Description: Semi-independent lessons, each with behavioral objectives and assessment tasks. Highly motivational. Very thoroughly developed and complete course guides. Not commercially available.

Title: Mathematics Laboratory

Level: Junior and Senior High School

School: Northern Senior High School

Contact Person: Mr. Wilmer Jones
3 East 25th Street
Baltimore, Maryland 21218 467-4000

Description: A mathematics laboratory utilizing a great many audio-visual aids and programmed materials. Remedial instruction provided to pupils who need help. No classes regularly scheduled into the lab.

Title: Applied Mathematics

Level: Grades 10-12

School: Baltimore County School System

Contact Person: Mr. Vincent Brant
6901 North Charles Street
Towson, Maryland 21204 825-7200

Description: A mathematics course for senior high students who are not in the college-bound program. This is not specifically a compensatory program but has worked well with this type student. Emphasis is on teaching mathematics which is relevant to the work and everyday activities of the student after he leaves school.

MINNESOTA

Title: None specified

Level: Grades 7-9

School: Washington Junior High School, Duluth, Minnesota

MINNESOTA - Continued

Contact Person: Mr. Dale Rapp
Washington Junior High School
Duluth, Minnesota 55802

Description: Individualized contracts were prepared by staff and students work on these at their own rate. Calculator work and motivational items are included.

MISSISSIPPI

Title: Computer Assisted Instruction in Mathematics

Level: Grades 2-7

School: McComb Separate Schools

Contact Person: J. D. Prince, Suprintendent
McComb Separate Schools
McComb, Mississippi 39648 684-4661

Description: The program consists of individualized instruction in mathematics handled by a computer located on a college campus generating signals for teletype machines located in classrooms in three school districts.

MONTANA

Title: General Mathematics Program

Level: Grades 7-9

School: Libby Junior High School

Contact Person: Carl Ergebretson, Superintendent
Libby, Montana 59923

Description: A program for individualizing the mathematics instruction for junior high school students.

Title: Creative Problem Solving

Level: Grades 4-8

School: Butte Public Schools, District 1

Contact Person: Leroy Casagranda, Federal Programs Director
111 North Montana Street
Butte, Montana 59701 406/723-8780

Description: Pilot demonstration program in developing creative problem solving in selected elementary students. Most of the students are from culturally deprived homes.

NEVADA

Title: Title III (PACE) Project

Level: K-6

School: Ruby S. Thomas Elementary School

Contact Person: Dr. Philip G. Kapfer
1560 East Cherokee Lane
Las Vegas, Nevada 89109 702/735-0878

Description: The teachers at Ruby Thomas Elementary School write packets called Individualized Learning Packages (ILP). These ILP's are "road maps" to book, non-book, and human resources for achieving stated learning or behavioral ob objectives -- they are not writing textbooks. The ILP design provides students with the opportunity to increasing human value, as observed in their self-initiating and self-directing behaviors with respect to (1) the library and (2) all learning resources, whether or not they are contained in the library.

NEW JERSEY

Title: Individualized Prescribed Instruction

Level: Grades 1-6

School: Washington School, Trenton, New Jersey

Contact Person: Dr. John Almond
Washington Street
Trenton, New Jersey 609/396-7646

Description: While not specifically aimed at the under-achiever, this program seems to be particularly effective for this type child. Dr. Almond feels that the reason for this is that the under-achiever does not feel threatened by the pressure of keeping up to the others.

Title: None specified

Level: Senior High School

School: Hackensack High School

Contact Person: Arthur Collard
First and Beech Streets
Hackensack, New Jersey 07601 201/488-4100 Ext. 31

Description: Under-achievers use flow charting to outline the procedure in the solution of problems, then does his computation on a desk calculator. Each student has his own calculator.

NEW JERSEY - Continued

Title: Trenton Advancement School

Level: Grades 10-12

School: Trenton Central High School

Contact Person: Robert Hanson or Pasquale Maffei
Trenton Central High School
Greenwood & Chamber Streets
Trenton, New Jersey 609/396-7646 Ext. 259

Description: This is a program in which primarily a laboratory and game approach is used in teaching mathematics to underachievers.

NEW YORK

Title: Skills Lab in Mathematics

Level: Grades 7 and 8

School: Mattlin Junior High School, Plainview, New York

Contact Person: L. Kramer, Assistant Superintendent or T. Tighe, Teacher
School Administration Building, Plainview, New York 11803

516/938-5400

Description: Students selected receive additional meetings during the regular school day in seminars of 4 or less. An informal atmosphere prevails to improve the students self-image and to stimulate his interest and motivation in mathematics.

Title: Center for Learning Development

Level: Grades 2-10

School: Levitttown Public Schools

Contact Person: Dr. Louis P. Pucci, Assistant to Superintendent
North Village Green, Levittown Public Schools
Levittown, New York 11756 516/796-6800

Description: After school center for small group (6 or less) remedial help. Instruction is paced to the individual child's rate of learning.

Title: A Preventive and Remedial Program in Reading, Arithmetic, Guidance and Social Work

Level: Grades 1-3

School: Lawrence Public Schools #1 and #2

Contact Person: Jerome P. Harris, Title I Coordinator
P.S. #4, Wanser Avenue
Inwood, New York 11516 516/295/2700

Description: Recommended children will be given an arithmetic diagnostic test to show their specific needs. The remedial arithmetic specialists plan individual or small group sessions during the regular school day in close harmony with the classroom teacher.

Title: Plus Program

Level: Early elementary through secondary

School: Various Buffalo Public Schools

Contact Person: William Fairlie
721 City Hall, Buffalo, New York 14202
716/842-3685

Description: Thirty-five remedial mathematics teachers work in this after school program. Individual and small groups are established

OHIO

Title: Pathways in Mathematics

Level: Grades 7-8

School: Cincinnati City

Contact Person: Miss Mildred Keiffer
230 East 9th Street
Cincinnati, Ohio 45202 513/621-7010

Description: Materials written, field tested, and published in consumable textbooks form, for under-achievers.

Title: Remedial Mathematics

Level: Grades 1-6

School: Cleveland City

Contact Person: Lawrence Hyman
1380 East 6th Street
Cleveland, Ohio 44114 216/696-2929

Description: A program being conducted in about twenty inner city schools. Resource teachers are being used to provide small group instruction in addition to regular classroom instruction.

MODEL COMPENSATORY PROGRAMS

OREGON

Title: UICSM Stretchers & Shrinkers and Motion Geometry

Level: Grades 7 and 8

School: Western View Junior High School, Corvallis, Oregon

Contact Person: James Baldwin
Western View Junior High School
Corvallis, Oregon 752-5141 Ext. 214

Description: None given

Title: UICSM Stretchers & Shrinkers and Motion Geometry

Level: Pre-Algebra

School: Chemawa Indian School, Salem, Oregon

Contact Person: Mrs. Mary Kay Randall
Chemawa Indian School
Salem, Oregon 585-4511

Description: None given

PENNSYLVANIA

Title: Dial Access Information Retrieval System

Level: Secondary

School: Coatesville Area High School

Contact Person: Eugene Hollick
Coatesville Area High School
Coatesville, Pennsylvania 19320 384-8100 (215)

Description: The Dial Access Information Retrieval System has been used to permit students to proceed individually. Its success can be attributed to the fact that a long preparation period preceded the actual use of the materials.

Title: Program for Learning in Accordance with Needs

Level: Elementary and Secondary

School: Pittsburgh School District

Contact Person: Howard Bower, Supervisor of Mathematics
341 South Bellefield Avenue
Pittsburgh, Pennsylvania 15213 682-1700 (412)

Description: The computer is used to determine Teaching-Learning Units adapted to a wide range of performance levels, rates of learning, and learning styles. This individualized approach has proved extremely helpful for disadvantaged students.

Title: Academic Games Project

Level: Elementary and Secondary

School: Allegheny County and Armstrong School District

Contact Person: Eugene Brown, Regional Director, Academic Games
Sunset Street
Rural Valley, Pennsylvania 16249 783-6164 (412)

Description: The mathematics games used are Equations, On-Sets, and Wff'N Proof. These have been used with a diverse variety of students and have been particularly effective as motivational tools with disadvantaged students.

Title: Individually Prescribed Instruction

Level: Elementary

School: Harrisburg School District

Contact Person: Harold Studer
Harrisburg City Schools
1201 North 6th. Street
Harrisburg, Pennsylvania 17015 234-6131 (717)

Description: The IPI materials, originated in Oakleaf Elementary School, Pittsburgh, have been used with low achievers to permit them to proceed at their optimum pace and engage in active participation in meaningful activities.

Title: Primes Project

Level: Elementary

School: California School District

Contact Person: Doris E. Creswell
31 Haar-Winn Building
Harrisburg, Pennsylvania 17126 787-6016 (717)

Description: PRIMES, "Pennsylvania Retrieval of Information for Mathematics Information Systems," has selected textbooks, content items, behavioral objectives, and manipulative materials for individualizing the students' program and assisting the teacher flexibly to meet student needs.

Title: Computer in Education

Level: Junior High School

School: Altoona School District

Contact Person: Thomas R. Heslep, Superintendent of Schools
1415 7th. Avenue
Altoona, Pennsylvania 16603 944-8101 (814)

Description: The computer terminal has been successfully used with slow learners and has demonstrated that such use has brought about achievement considerably better than the achievement of peer groups taught by traditional methods.

Title: Systems Approach to Improving Mathematics

Level: Fourth Grade

School: Pittsburgh School District

Contact Person: Willis Hickey, Supervisor of Elementary Mathematics
341 South Bellefield Avenue
Pittsburgh, Pennsylvania 15213 682-1700 (412)

Description: This program provides an integrated system of instructional tools, including films, to individualize, instruct and direct the teacher to optimum use of the materials. The achievement of the less able students has been substantially improved.

Title: Pennsylvania Advancement School Program

Level: Secondary

School: Philadelphia School District

Contact Person: Martin Cohen
Philadelphia Board of Education Building
Philadelphia, Pennsylvania 19103 448-3671 (215)

Description: Low achievers at the secondary level, chiefly junior high school, are exposed to a variety of imaginative approaches involving manipulative materials, games, etc. They are then encouraged to take these procedures back to their classrooms.

Title: Low Achievers' "Stretchers and Shrinkers"

Level: Secondary

School: Philadelphia School District

Contact Person: Leonard Sloan
Philadelphia Board of Education Building
Philadelphia, Pennsylvania 19103 448-3671 (215)

Description: A number of teachers have received in-service education from the University of Illinois to present the UICSM "Stretchers and Shrinkers," an extremely motivating program for underachievers. This program is continuing with the UICSM Geometry.

Title: Division of Instructional Systems

Level: Elementary and Secondary

School: Philadelphia School District

Contact Person: Dr. Sylvia Charp, Director
Instructional Computer Center
Fifth & Luzerne Streets
Philadelphia, Pennsylvania 19140

Description: Diversified use is made of the computer in working with the underachiever, beginning in the intermediate grades. Computer assisted instruction involves and instructs; the computer is used to solve problems; and vocational experiences are given.

Title: Huntingdon Area High School Mathematics Laboratory

Level: Secondary

School: Huntingdon School District

Contact Person: John O. Rittenhouse, Jr.
Head of Mathematics Department
Huntingdon Area High School
Huntingdon, Pennsylvania 16652 643-1080 (814)

Description: There is a diversified laboratory approach used. An individual student response system encourages each student to participate in class activity. Use is made of field instruments, desk calculators, a computer, and audio-visual materials to motivate and instruct.

Title: Allentown Slow Learner Program

Level: Junior High School

School: Allentown School District

Contact Person: Robert W. Brong
Administration Bldg.
31 South Penn Street
Allentown, Pennsylvania 18105 435-7401 (215)

Description: The Cincinnati Program, a non-commercial program using contemporary mathematics, is used. Both oral and written presentations are used consistently. Little homework is given and the students have participated very effectively.

Title: Educational Improvement Program

Level: Elementary Grades

School: Philadelphia School District

Contact Person: Mrs. Naomi Taylor, Mathematics Consultant
Philadelphia Board of Education
Philadelphia, Pennsylvania 19103 448-3671 (215)

Description: This program aims at having the children develop confidence in themselves and encourages experimentation. They are encouraged to find original ways of solving problems. An extensive program of teacher education is maintained.

RHODE ISLAND

Title: Computer Mathematics for the Slow Learner

Level: Grades 7 and 8

School: Nanagansett Junior High School

Contact Person: Miss Maxine Mason
Nanagansett Junior High School
Nanagansett, Rhode Island 789-9321 (401)

Description: The Programma 101 was used to arouse interest in and develop an understanding of mathematics formuli and their solutions.

Title: Using Cuisinaire Rods to Teach Mathematics Concepts

Level: K-1 (To go to second grade)

School: City-wide (13 schools)

Contact Person: Peter Vengel
Womsocket School District
Womsocket, Rhode Island 766-5760

Description: Consultant is Mrs. Miriam Kronish - Training in the use of Cuiseniare small groups.

SOUTH CAROLINA

Title: Advanced General Mathematics III - Component Four of a Project to Expand the Supplementary Services Center of South Carolina Region II

Level: Grade 11

School: South Carolina ESEA Region II, Centered at Orangeburg School District, Number 5, Orangeburg, South Carolina (18 high schools participate in the project)

Contact Person: William B. Hynds, Mathematics Consultant
State Department of Education
801 Rutledge Building
Columbia, South Carolina 29201 758-2876 (803)

Description: This course, designed for capable non-college bound students, relies heavily on visual aids and student involvement in offering an inductive development of mathematical concepts. Its content, recommended by persons from industry and technical education programs, is a development of ratio, geometry and trigonometry with an introductory unit on slide rule manipulation and optional lessons in probability. It is the third course of a proposed four year general mathematics curriculum for high school students of average ability.

TENNESSEE

Title: Memphis Community Learning Laboratory

Level: Elementary

School: Memphis Community Learning Laboratory

Contact Person: Dr. Joseph P. Atkins
370 South Orleans Street
Memphis, Tennessee 38126 527-3497 (901)

Description: Developing materials for inner city students.

Title: Piney Woods School

Level: Nursery through sixth grade

School: Piney Woods

Contact Person: Lyda McKaldin
Chattanooga City Schools
Chattanooga, Tennessee 37404 821-2513 (615)

Description: Individualized learning situation - most students from very poor background.

APPENDIX E

LIST OF RESOURCE PERSONS

ALABAMA

State Personnel

Mrs. Charlotte H. Jones	1812 Lancaster Road, Birmingham 35209
Mr. Lloyd M. Crook	402 State Office Building, Montgomery 36104

University Personnel

Dr. W. D. Peeples	Samford University, Birmingham
Dr. John Locker	Florence State University, Florence
Dr. Kenneth Easterday	Auburn University, Auburn
Mr. David Shippy	Box 128, Huntsville
Dr. Laura Newell	Auburn University, Auburn
Dr. Esther Swenson	University of Alabama, University

ARKANSAS

State Personnel

Mr. Truett Goacher	State Department of Education, Little Rock 72201

University Personnel

Mr. Gene Catterton	Wynne Public Schools, Wynne

CALIFORNIA

State Personnel

Wilson C. Riles	Director, Office of Compensatory Education 1500 Fifth Street, Sacramento 95814

University Personnel

Dr. Marjorie Rapp	The Rand Corporation, 1700 Main Street Santa Monica 90406
Vernon Broussard	701 North Madison Street Stockton
Dr. Viggo P. Hansen	San Fernando Valley State College 18111 Nordhoff Street, Northridge 91324
Mr. Marvin L. Johnson	Long Beach Unified School District 701 Locust Avenue, Long Beach 90813

CALIFORNIA - Continued

Mr. William F. Johntz	1011 Keith Avenue, Berkeley 94708

COLORADO

State Personnel

Glyn H. Sharpe	Colorado Department of Education, Denver 80203

University Personnel

Dr. Ruth Hoffman	Mathematics Department, University of Denver, Denver
Mr. Terry Shoemaker	Box Q, Douglas County Schools, Castle Rock 80104
Mr. Don Colvin	Box Q, Douglas County Schools, Castle Rock 80104

CONNECTICUT

State Personnel

Miss Elizabeth M. Glass	State Department of Education, Hartford

University Personnel

Prof. Richard L. Mentzer	Central Connecticut State College, New Britain
Mrs. Florence Plato	Southern Connecticut State College, New Haven
Sister Mary Brunnel	Western Connecticut State College, Danbury
Raymond Walch	Eastern Connecticut State College, Willimantic
Dr. Vincent Glennen	University of Connecticut, Storrs
Mrs. Florence Jacobson	Albertus Magnus College, New Haven
Sister Elizabeth Markham	St. Joseph College, West Hartford
Dr. Cecilia Welna	University of Hartford, Hartford
Mr. Lynn Anderson	Vernon Center Middle School, Vernon
Mr. Malcolm Austin	105 Main Street, Norwalk
Miss Linda Ball	Glastonbury High School, Glastonbury
Mrs. Carla Berger	105 Main Street, Norwalk
Mr. Russell Debelstein	Joel Barlow High School, Redding
Mr. Robert Gregoraki	Southbury High School, Southbury

CONNECTICUT -- Continued

Mr. Matthew Hunyadi	45 Lyons Terrace, Bridgeport
Mr. Robert Kellar	Town School Office, Westport
Mr. Charles Kopner, Jr.	Avon High School, Avon
Mr. Harry Levitan	Wilbur Cross High School, New Haven
Mr. Nathaniel Mann III	Beecher Road School, Woodbridge
Mr. Ralph Money	Middlebrook School, Trumbull
Mr. Eugene O'Hara	Newtown High School, Newtown
Miss Ella Rice	100 Reef Road, Fairfield
Mr. Alfred B. Tychson	Havemeyer Building, Greenwich

FLORIDA

State Personnel

Mrs. Renee Henry	State Department of Education, Tallahassee 32304

University Personnel

Dr. Jack Foley	Florida Atlantic University, Baca Raton
Mrs. Andria Troutman	Hillsborough County Schools, 707 East Columbus Drive Tampa
Dr. William Engel	University of South Florida, Tampa
Dr. Kenneth Kidd	Norman Hall, University of Florida, Gainsville
Mrs. June Ellis	Miami Springs High School, Miami Springs

GEORGIA

Mrs. Faye Windham	Barnesville Elementary School, Barnesville
Mrs. Madelyn Golightly	South Fulton High School, East Point
Miss Sandra Fountain	North Roswell Elementary School, Roswell
James Hunter	Thomasville High School, Thomasville
Mrs. Betty Rhodes	Thomasville Middle School, Thomasville
Mr. Bobby Jones	Curriculum Director, P. O. Box 6157, Macon 31208
Mrs. Elizabeth H. Lambert	Cynthia H. Weir School, 1180 Crestline Drive, Macon

GEORGIA - Continued

C. Sue Phelps	Instructional Services Center, 3106 South Dixie Highway, Dalton 30720
Geneva Trammell	North Whitfield High School, Dalton 30720
Mrs. Glennis Rockett	Sherwood Elementary School, Albany
Miss Winifred Colquitt	McEvoy Senior High School, Macon
Mrs. Susan Harkins	Rothschild Junior High School 1136 Hunt Avenue, Columbus 31907
Mrs. B. P. Baldwin	Hardaway Senior High School 2101 College Drive, Columbus 31906
Dr. William D. McKillip	The University of Georgia, Athens
Dr. Len Pikaart	The University of Georgia, Athens
Helen D. Boatwright	Marietta Junior High School, Marietta 30060
Mr. William Watkins	Lyons Junior High School, 2190 Winterville Road Athens 30601
Mr. Bennie Perkins	Carver Junior High School, Albany
Dr. Fredrika K. Reisman	University of Georgia, Athens 30601
Carolyn Cox	O'Keefe High School, 151 Sixth Street, Atlanta 30313
David Borland	O'Keefe High School, 151 Sixth Street, Atlanta 30313
Mrs. Carol Babcock	Silas Floyd Elementary, 921 Florence Street Augusta 30901
Mrs. Mary E. Terrell	Silas Floyd Elementary, 921 Florence Street Augusta 30901
Mrs. Ida Rox	Windsor Springs, Windsor Spring Road, Augusta 30906

HAWAII

State Personnel

Naomi K. St. Denis	Box 2360, Honolulu, Hawaii 96804
Richard Dennis	Box 2360, Honolulu, Hawaii 96804

University Personnel

Dr. Anthony J. Picard	University of Hawaii, 1776 University Avenue Honolulu 96822

ILLINOIS

State Personnel

Joseph P. Cech	8341 North Kenneth Avenue, Skolie 60076
Miss Frances Hewitt	301 Dickinson Road, Springfield 62704
Warren W. Lionberger	2118 West Lawrence, Springfield 62704
Roland G. Long	7 Crownview Drive, Mt. Vernon 62864
Richard C. Meckes	2621 Bennington Drive, Springfield 62704
John G. Stoudt	504 Maple Avenue, Morrison 61270

University Personnel

Dr. Max Beberman	University of Illinois
Dr. Kenneth Retzer	Illinois State University
Dr. Ian Beattie	Southern Illinois University
Mr. Dale Jungst	Northern Illinois University
Dr. Joe Harkin	Western Illinois University
Dr. Kenneth Travers	University of Illinois

KANSAS

State Personnel

Mrs. Lucile Asher	120 East 10th Street, Topeka 66612

KENTUCKY

State Personnel

Russell Boyd	State Office Building, Frankfort 40601

University Personnel

Dr. Billy Nail	Morehead State University, Morehead 40351

LOUISIANA

University Personnel

Miss Lurnice Begnaud	P.O. Drawer 2158, Lafayette Parish School Board Lafayette, Louisiana 70501

MARYLAND

State Personnel

Thomas E. Rowan	Maryland State Department of Education 600 Wyndhurst Avenue, Baltimore, 21210

University Personnel

Dr. James Henkelman	University of Maryland, College Park
Dr. Robert Ashlock	University of Maryland, College Park
Mr. Vincent Brant	Baltimore County Schools, Towson
Mr. Wilmer Jones	Baltimore City Schools, Baltimore

MINNESOTA

State Personnel

David L. Dye	State Department of Education, St. Paul 55101

University Personnel

Dr. Robert Jackson	University of Minnesota, Minneapolis 55455
Dr. David C. Johnson	University of Minnesota, Minneapolis 55455

MISSISSIPPI

State Personnel

John O. Ethridge	State Department of Education, Jackson 39205

University Personnel

Ronald Carruth	605 Minnesota Avenue, McComb 39648
Dr. Eleanor Walters	Delta State College, Cleveland 38732

MONTANA

State Personnel

Lee N. Von Kuster	Office of Superintendent of Public Instruction Helena 59601

NEVADA

State Personnel

Ron Gutzman	State Department of Education, Carson City 89701

NEVADA - Continued

Jim Kiley	State Department of Education, Carson City 89701
Jack O'Leary	State Department of Education, Carson City 89701

University Personnel

Malcomb Graham, Ph.D.	University of Nevada, Las Vegas
Virginia Gilbert, Ph.D.	Clark County School District, Las Vegas
Phillip Kadfer, Ph.D.	Clark County School District, Las Vegas

NEW HAMPSHIRE

State Personnel

Fernand J. Prevost	State Department of Education, Concord 03361

University Personnel

Dr. Richard Balomenos	University of New Hampshire, Durham 03824
Mrs. Ruth Chase	Portsmouth Junior High School, Portsmouth 03801

NEW JERSEY

State Personnel

Vincent M. Acquaviva	225 West State Street, Trenton 08625
Robert G. Bongart	225 West State Street, Trenton 08625

University Personnel

Dr. Ernest Duncan	Rutgers University, New Brunswick
Dr. Max A. Sobel	Montclair State College, Upper Montclair
Dr. William Hausdoerffer	Trenton State College, Trenton
Dr. John Recktenwald	Jersey City State College, Jersey City
Dr. Joshua Barlaz	Rutgers University, New Brunswick

NORTH CAROLINA

State Personnel

John W. Ogle	State Department of Public Instruction, Raleigh
Cleo M. Meek	State Department of Public Instruction, Raleigh

NORTH CAROLINA - Continued

University Personnel

Dr. Larry Watson	North Carolina State University, Raleigh
Dr. John Kolb	North Carolina State University, Raleigh

OHIO

University Personnel

Miss Mildred Keiffer	Cincinnati Schools, 230 East 9th Street Cincinnati 45202
Mr. Harold Smith	Cincinnati Schools, 230 East 9th Street Cincinnati 45202
Mr. Lawrence Hyman	Cleveland Schools, 1380 East 6th Street Cleveland 44114

OREGON

State Personnel

Don Rasmussen	Oregon Board of Education, 942 Lancaster Drive, N.E. Salem 97310

University Personnel

James Baldwin	Western View Junior High School, Corvallis
Mrs. Mary Kay Randall	Chemawa Indian School, Salem
Wayne Neuberger	904 Wimberly, Las Cruces, Nex Mexico

PENNSYLVANIA

State Personnel

Carl E. Heilman	Coordinator of Science & Mathematics 566 Education Building, Harrisburg 17126
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Carl A. Guerriero	Mathematics Education Advisor 566 Education Building, Harrisburg 17126
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PENNSYLVANIA - Continued

Dorothy Hoy	Mathematics Education Advisor 31 Haar-Win Building, Harrisburg 17126

University Personnel

Sol Weiss	West Chester State College, West Chester 19380
Mrs. Lora Rasmussen	Pennsylvania School District, Philadelphia 19103
L. Gioth Burns	Bucks County Schools, Doylestown 18901
Mrs. Mamie Wadkins	Knoxville Junior-Senior High School, Pittsburg 15210
Miss Mary Wandel	Pittsburg Board of Education, Pittsburg 15213

RHODE ISLAND

State Personnel

Arthur J. McMahon	Rhode Island Department of Education, Providence 02908

University Personnel

Dr. Thomas Nally	Rhode Island University, Kingston

SOUTH CAROLINA

State Personnel

William B. Hynds	State Department of Education, 801 Rutledge Building Columbia, South Carolina 29201

University Personnel

Mrs. Cornelia Turnbull	Richland School District Number One 1616 Richland Street, Columbia 29201
Mrs. Marian K. Jenkins	Camden Senior High School, Laurens Street Camden 29020

TENNESSEE

University Personnel

Lyda McKeldin	Chattanooga City Schools, Chattanooga 37404
Jack Conner	Chattanooga City Schools, Chattanooga 37404

WISCONSIN

State Personnel

George L. Henderson	126 Langdon Street, Madison
Arnold M. Chandler	126 Langdon Street, Madison

University Personnel

Peter Christiansen	Madison Public Schools, Madison
Lowell Glunn	Monona Public Schools, Monona
John Aceto	Racine Unified Schools, Racine
William Cable	Wisconsin State University, Stevens Point
Dr. Walter Leffin	Wisconsin State University, Oshkosh