DOCUMENT RESUME

ED 249 740 EC 170 852

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TITLE Mislabeled, but Not Misidentified. Final Progress Report, 7/1/80-6/30/81.
INSTITUTION California Univ., San Diego. Laboratory of Comparative Human Cognition.
SPONS AGENCY National Inst. of Education (ED), Washington, DC.
PUB DATE 13 May 82
GRANT NIE-G-80-0063
NOTE 36p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; Elementary Education; Expectation; Games; Grouping (Instructional Purposes); *Interpersonal Competence; *Language Handicaps; *Language Skills; *Problem Solving; Student Motivation; Teaching Methods

ABSTRACT

The paper describes research examining the interrelationships among cognitive, linguistic, and social development in a sample of dysphasic children (having severe linguistic problems disproportionate to cognitive abilities) using microprocessors as a special diagnostic and training environment. Two studies are described; the first (the Comparison Study) examined problem solving, social skills, and linguistic performance of eight dysphasic and eight normal 8- to 10-year-olds on diagnostic and computer-based tasks. Ss worked on computer games in cooperative and didactic sessions. The performance of dysphasic Ss was lower on almost all measures. In the second study (the Training Study), the dysphasic Ss were given training in problem solving on computers. With small amounts of training, the performance of dysphasic Ss resembled that of the control group. The results of both studies suggest that students' educational history can result in the development of secondary deficits. Lower performance is not always a property of individual deficits, but occurs within a system of interrelated activities. Among educational implications discussed are ways to draw the children into educational experiences, in part by redirecting their metacognitive skills from task avoidance to task analysis; considerations in grouping children with language problems; and the role of computers in education. (CL)

FINAL PROJECT REPORT [illegible]
NIE Grant No. G-[illegible]
Project Title: A Comparison of the
Learning Strategies of Language
Impaired and Normal Children
Prin. Investigator: Michael Cole
Period: [illegible]

Mislabeled, but not misidentified

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INTRODUCTION

Overall research program

The research summized here is part of a general effort on our part to provide a principled basis for designing productive educational environments for learning handicapped children.

As described in Cole and Traupmann (1980), children who experience language--related learning problems may be able to learn effectively if the conditions permit them to use their considerable intellectual ability.

The particular goal of this project was to examine the interrelationships among cognitive, linguistic and social development in a sample of learning handicapped children using microprocessors as a special diagnostic and training environments. The research literature indicates the existence of a population of children, referred to as dysphasic, who have severe linguistic problems that are disproportionate to their cognitive abilities (Eisenson, 1972; Ingram, 1975; Morehead & Morehead, 1976; Bloom & Lahey, 1978). Almost no mention is made of the effect of the language problems on social development. This leaves us with the belief that social skills are only minimally affected by the language problems. A group of dysphasic children could be very useful in understanding how language development is tied to cognitive and social skills and possibly the degree to which these different aspects of development can proceed independently.

Most of the existing research on dysphasia has been carried out with very young children examining the delayed or deviant language acquisition process (Menyuk, 1968, 1976; Eisenson & Ingram, 1972; Morehead, 1972; Johnson & Schery, 1976; Bloom & Lahey, 1978). We have been interested in how the delayed or deviant language learning process influenced other aspects of development. We therefore chose to look at older children. Finding older children with language problems was not in itself difficult. But the nature of their language problems and the structure of their other skills were very difficult to determine.

The results of two studies are reviewed in this report. The first, the Comparison Study, examines the problem-solving strategies, social skills and linguistic performance of eight dysphasic and eight normal children (ages 10-12 years) on diagnostic computer-based cognitive tasks. Three computer tasks involving (1) estimation, (2) perceptual/spatial and (3) inference skills were used. Pairs of students from the Language (linguistically impaired) and Control (linguistically normal) groups worked together on computer games in two types of sessions, Cooperative and Didactic. Cooperative sessions were those in which there was symmetrical game knowledge, and the game was new to both players. Didactic Sessions were those in which there was asymmetrical game knowledge; the game was known by one student who was placed in the role of the teacher while the other student assumed the role of the learner.

Performance was compared in terms of two types of problem solving measures (problem-framing and game-playing skill) two linguistic measures (language fluency and language errors) and social measures which characterized skill in adopting the roles of teacher and learner.

The performance of the Dysphasic children was lower on almost all measures. Their lower performance provided the motivation for a phase of the research referred to as the Training Study. The Dysphasic students were provided training in solving problems presented on computers. The training sessions evolved gradually from computer controlled playing to student controlled playing as the students demonstrated more skill. With small amounts of training on the computer, the performance of the Dysphasic children resembled that of the control group.

The results of both studies suggest that students' educational history can result in the development of secondary deficits. Lower performance is not always a property of individual deficits, but occurs within a system of interrelated activities. Understanding this system is vital to efforts to create effective educational programs for these children. Computers can be effective tools for the development of educational programs for children in special education.

In this report we first discuss some of the difficulties in locating older dysphasic children. We then review the major results of the Comparison and Training Studies (Riel, 1982). Finally, we address the educational implications of these findings. Suggestions will be made for structuring the educational environment of children with language problems so that knowledge acquisition is not delayed by concentrating on areas of weakness rather than areas of strength.

INSTITUTIONAL AND CLINICAL IDENTIFICATION OF DYSPHASIC CHILDREN

We uncovered a certain tension between the clinical definition of dysphasia and institutional constraints on the categorization and educational placement of these children. While there are both clinical and institutional definitions of dysphasia, the group of children isolated by these definitions are far from isomorphic. The clinical/research definition of dysphasia is a developmental problem with receptive and/or expressive language that is not attributed to any known cause (deafness, injury, autism, et cetra) occurring in children with normal (85 or higher) nonverbal IQ scores (Ingram, 1975).

The school district, partially in response to the demands of federal legislative mandates for the special education of handicapped students, has established a number of educational programs including special classrooms for the "Severely Language Handicapped" (SLH). SLH is an educational, institutional definition of children with language difficulties. So defined, these language handicaps are delays of one year or more behind mental age in at least two aspects of language (phonology, syntax, semantics and pragmatics) in children of normal intelligence.

Given the similarity in clinical and institutional definitions of children with language difficulties, we expected to find dysphasic children in SLH classrooms. However, we did not find this match between clinical and institutional definitions operating in actual educational practice. Not all students in SLH classrooms were dysphasic. Based on IQ test scores, some children were "mentally retarded." Other children seemed to be in the SLH classroom because they spoke two languages with limited success. Still others had learning problems that defied categorization.

It did not seem that the educators in this district were themselves to clinical criteria in placing students into the SLH classroom. Considerations of a fiscal, legal, and practical nature also influenced the placement of students into this classroom. The federal law governing special education mandates that twelve percent of the school aged population will be served by special education programs. The compulsory thrust of this law provides an incentive to search for, identify, and place students into special education programs in order to meet mandated quotas. The legal incentive to search for students is reinforced by financial incentives. School districts are provided funds from state and federal sources for each student in regular classrooms, and a greater amount of money for students in special education programs. They receive more money for students in "pullout" programs and still more money for students in "whole day" programs. This additional source of money also serves as an incentive to search for students to place in special education. As a result of these factors, placement decisions are based on an interlacing of these considerations and such factors as space and money available.

Even without these constraints, children rarely fit easily into one of the categories that have been established. The Psychometric measures, school achievement tests, and evaluation by the school psychologist and the classroom teacher frequently conflicted in their determination of which students were typical examples of dysphasic children. A good example of this is Pat, a sixth grader from School. The school psychologist suggested that Pat might not be dysphasic because her scores on the WISC-R did not show a large spread. The psychologist said that Pat might well be learning disabled like her

brother. On the other hand the classroom teacher selected Pat as the prototypical dysphasic child. Pat's school achievement scores support the teachers evaluation. In math she is a full year above grade level and in language arts, she is several years below grade level. According to the teacher, she also has great difficulty in retelling events or expressing her ideas in either verbal or written form. The Token Test did not indicate a receptive language problem (consistent with the psychologist's evaluation) and her score on the Ravens indicated above average intelligence (inconsistent with the psychologist's evaluation).

If Pat had been unusual, it would have been easy to exclude her from this study. Yet, she was one of the four students selected out of a group of twelve students as the best examples of dysphasic children in that school. It is possible that more testing or different tests would result in a pattern that would identify Pat as dysphasic or as not dysphasic. It is doubtful, though, that such testing will provide the kinds of recommendations that will enable Pat to succeed in school. Even if it were possible to separate children who had a particular problem with language, they are a number of problems with the educational practice of grouping them together in small numbers for instruction.

THE SYSTEM OF DEVELOPMENT

In the Comparison study, we examined the problem-solving, linguistic and social skills of language-impaired and normal children. Analyzing each of these skill domains, in isolation, did not display the total system within which they operate. In fact looking at them in isolation leads to inferences

about the abilities of these children that are not warranted when the whole system is considered.

Summary of the Comparison Study

We begin by summarizing the similarities and differences between the Language and Control Groups that were observed during the Comparison study. Trying to account for the differences requires a widening of my theoretical focus. By reformulating the nature of the task to which the Language students were oriented, a different way of interpreting the behavior of these students becomes possible.

Similarities. All the students approached and played the games with interest. They all seemed to enjoy interacting with the computer. On subsequent visits to the school, children from both groups urged us to bring the computer back. They understood the procedures that were established for the different sessions and generally followed instructions.

There were no group differences in the amount of language used by the students while playing the games. The Language students were just as verbal as the Control group. In contrast to the research of Ingram (1972), the Language students asked more, not fewer questions. The mean length of communication units was the same for each group as was the number of words per minute. Both groups of students used language to regulate their own behavior and to direct the behavior of their partner.

The students were able to coordinate game playing and establish their own systems for dividing up the task or taking turns. With a few minor exceptions, the students worked out disagreements that arose among themselves without requesting or needing adult intervention. The students in both groups were as likely to ignore questions from their peers as they were to answer them correctly.

Differences. Dysphasic children were selected because of their history of difficulties with language. It was not surprising, then, that they demonstrated more problems related to language use than did the Control students (these differences are described in more detail in Riel, 1982). The Language students spent less time giving information and used fewer communication units to explain the games to their peers than did the Control students. The Language group got bogged down more often in language mazes, indicating that they had more trouble expressing their thoughts in words. Their pattern of language errors was in some ways similar to their game playing pattern, in that they were more likely to take liberties in modifying linguistic relationships. In most cases, they did not seem to be lacking a formal knowledge of language. They were more likely to construct utterances that on some occasions did, and on other occasions did not, conform to linguistic conventions.

The language difficulties of dysphasic children have consequences for their social and problem solving behavior. The Language students were highly dependent on adult help to solve problems. They turned to the adult first, rarely consulting the machine or each other. Computer help required a minimal amount of reading and peer help required a higher degree of verbal explicitness than was necessary to elicit adult help. The Control students turned

first to the computer, then to their peer and only to the adult as a last resort when a problem could not be solved. Even when the Language students were directed to the computer or to their peer for help they continued to request adult help.

Another way in which the behavior of the Language students differed from that of the Control students was in their way of dividing up the task. The Language students took turns playing the games, attributing success or failure to the individual. The Control students were more likely to divide up the tasks within a game and work jointly, sharing the responsibility for success and failure. Working together involves sharing perspectives to reach a common understanding of the game and the strategies for playing the game. Problems with language could be interpreted as responsible for difficulty engaging in joint problem solving.

Finally, all the Language students demonstrated very different problem solving skills from the Control students. They did not approach and organize the problem-solving situation in a way that would enable them to succeed. They frequently began games without instructions and did not move down in level when a game proved to be too difficult. They played twice as many games at a level at which they had a low percent of successes than at a level at which they had a fairly high rate of success. Despite their low rate of success, they persisted at activities that were too difficult. They had more trouble organizing the game playing situation and conforming to the constraints of the games. Rather than choose an easier game level, they were more likely to change the game rules to accommodate their understandings. The control students monitored the problem solving situation and their own skills,

working reasonably efficiently towards the goal of playing the game well. The Language students on the other hand, demonstrated very poor problem framing skills.

This pattern of differences indicates that the language difficulties of these children do have consequences for the development of other skills. As can be seen from these findings, language was not the only area of difficulty for most of these children. Attempts to be more precise about the type of problems these children have in other areas of development are hindered by the variability of their performance.

A common observation among researchers and clinicians is that the performance of dysphasic children on IQ tests is highly variable. Because intelligence is conceived of as a property of the individual; even if a person exhibits intelligent behavior only from time to time, he or she is, nevertheless, said to possess the property. Factors such as lack of attention, poor concentration or low motivation are assumed to be responsible for the inconsistencies. Dysphasic children are, therefore, described as having normal intelligence, but short attention spans.

Our interpretation of these reports was that the children were not interested in testing. Not understanding the consequences of their behavior, they were not taking the testing seriously and were not motivated to do well. Our choice of computer games was directly influenced by these observations. We assumed that the students would be very excited about playing computer games and with this high motivation the inconsistency of behavior would not be a problem. Our premise about motivation was correct but the inference concerning behavioral consistency did not follow. The children were very excited

about the games and were eager to play but their performance remained highly variable. This inconsistency of behavior makes it very difficult to assess the common patterns of skills or abilities of these children with any confidence. Variable performance can be seen in a number of different situations.

It is clearly evident in the pattern of language errors made by these children. For most of the language errors recorded, there were numerous examples of the same linguistic construction formed correctly. This indicates that at least on some occasions the students understood the grammatical relationships that govern a particular construction. We have no principled reason for, or clear way to characterize, the environments in which language errors were made versus those in which no errors were made. It is as if language lacked automaticity such that when other systems of interaction competed for cognitive resources, linguistic production suffered.

It was also difficult to determine when a student in the Language group understood how to play the games. On one occasion a student may be playing so well that there is no doubt that he understands the game. On a later occasion, the student performs below the level of chance. This on/off quality of performance was most striking during the Training Study as the students played the same game over a period of several weeks. It would be easy to say that the language students simply lost interest in the game and therefore stopped concentrating. This did not seem to be the case. The student was eager to demonstrate that he was ready to teach the game to another child. He knew his performance was being evaluated and wanted to play well, but it was as if he had forgotten how to play. Several hours later when he was given another chance to play, he appeared to have remembered. Again, we could find no prin-

cipled way to account for the inconsistencies of performance. At the time when knowledge of the game fades, the students sometimes remained eager to play and other times abruptly decided that they did not want to play any more that day.

Even auditory perception seemed to vary under different conditions for some of these children. In the "Astronaut" game there was a sound pair discrimination task that was similar to the test that Tallal (1976) used to locate deficits in auditory processing in dysphasic children. The interval between the two sounds decreased as the level of difficult of the game increased. At level four and five the interstimulus intervals were less that 53 milliseconds, a condition which resulted in discrimination problems for children with auditory processing problems. Watching the children play the games it seemed clear that the sound discriminations were more difficult for the dysphasic children than the Control students. After the sessions were over, we gave the children in the Language group a tone test. This was done by dividing up the tasks in the game so that the Language student was only responsible for a small part of the task. We navigated the space ship in the game that they did not need to monitor direction or worry about crashing into a planet. Under these circumstances, some of the children who had difficulty with the sound discriminations during the Comparison Study, now played error free.

One way to understand these inconsistencies in performance is to assume limited ability on the part of the students. The Language students would been described as lacking certain skills or having limited processing ability. But such formulations usually only account for one aspect of behavior and can not

account for the whole configuration of behavior.

An additional interpretation that could be drawn from observation of the poor problem framing moves of the Language students, is that they lack metacognitive abilities (cf., Torgeson, 1977). To examine this possibility it is important to establish what is meant by metacognitive abilities.

Baker and Brown (1982) suggest that two clusters of metacognitive abilities are involved in problem solving. The first involves the person's knowledge about his or her cognitive resources, the demands of the situation and the match between cognitive resources and task complexity. The second cluster are self-regulatory mechanisms used during any attempt to solve problems. These include:

> Checking the outcome of any attempt to solve the problem, planning one's next move, monitoring the effectiveness of any attempting action, testing, revising, and evaluating one's strategies for learning. (1980:6)

Examining the problem solving performance of the Language Students in these computer sessions, it would be possible to conclude that they lacked metacognitive abilities. Their way of structuring the game playing situation does not, on the surface, suggest that they understand the demands of the task in relationship to their own abilities. They did not exhibit the same kind of checking, planning, monitoring, testing, revising and evaluating strategies that were used by the Control students in learning these games.

Once a deficit is located, possible causal relationships are drawn between this deficit and known problems with language. In the example used, metacognitive deficits could be related to language problems in at least two ways.

One way of relating them is to assume that the lack of metacognitive skills is the direct result of the language problem. The logic of the argument is as follows. Because the students have more difficulty in representing ideas to themselves verbally or are less able to use language to regulate their behavior, it becomes more difficult for them to engage in planning, monitoring and checking behavior.

Conversely, it could be claimed that the lack of metacognitive skills are themselves responsible for the linguistic problems. In this case, the logic would be that metacognitive skills are necessary for organizing ideas and coordinating the rules of the language to produce acceptable utterances. Therefore, deficits in metacognitive skills will be manifested in difficulties with linguistic expression and decoding. Both these formulations interpret the absence of a behavioral display in one setting as evidence for a general deficit.

But by examining the whole system of behavior of the Language students in these game playing situations, it is clear that they were engaging in metacognitive activities and doing so very skillfully. However, their checking, planning, monitoring, testing, revising and evaluating strategies are directed at another aspect of interaction. The Language students have different goals that superceded playing the game well. They were actively working to construct a situation in which they did not have to face doing things that they did not believe that they could do well. For them, the nominal task of the computer game is secondary to doing well in a larger context (Birney, Burdick & Tecran, 1969). In sociological terms, they were primarily occupied with "passing and managing" the scene (Goffman, 1959; Garfinkel, 1967; Edgerton,

1967).

The metacognitive skills of these children can be observed in their more frequent questions about session procedures, their verbalizations about being taped and concern with who would view the tapes, and especially in their strategies for avoiding situations that are likely to be problematic for them. These strategies will be discussed in the following sections.

Metacognitive Strategies of the Language Students during the Comparison Study

If we change the focus of attention to how the Language students were managing the larger scene, then the causes of some of the inconsistencies in their behavior become clearer. Their actions can be interpreted in terms of strategies for managing the situation to pass as competent students.

Strategies for Avoiding Reading. The students in the Language group were aware of their reading difficulties and they actively avoided situations that required reading. One way they did this was to claim to know how to play, bypassing the instructions and then seeking adult help after the game began. When the help they received was directions to go back through the computer instructions, they had various strategies for assuring the co-presence of the adult to help them through the instructions. In one case when the experimenter was trying to encourage a language dyad to work together one of the students, clearly frustrated with the comprehension aspect of reading, announced that the game was not fun as had been promised. In effect she was saying that if the experimenter didn't give her the form of help she wanted immediately, she would not continue in the situation. It may well have been a bluff which the experimenter could have called by inviting her to return to

the classroom, but the experimenter could not afford to find out and the child may well have suspected it.

Strategies for Avoiding Failure. It is possible that the inappropriate choice of high game levels was not the result of poor problem framing skills alone, but at least partially motivated by fear of failure and strategies for avoiding failure (Birney, Burdick & Tecran, 1969). Playing at a level so easy that everyone can do it or at level so difficult that few can succeed provides very little information about the skill of the player. If one is uncertain about one's ability at a level that is described as easy, then a possible strategy for avoiding evaluation is to persist at the most difficult level. If one tries but does not succeed on the most difficult task the failure is not attributed to lack of skill on the part of the player but to the difficult nature of the task. If one persists at a game that is too hard, he can always believe or assume that others believe that he would be able to do much better on the easier level. Another strategy the Language students sometime used to avoid failure was to give up on the game as defined by the computer and redefine it so that they were successful.

Strategies for Avoiding Peer Instructions. The Language students used two different strategies for avoiding the teacher-student role relationship. The first was to claim to know how to play before the student teacher had provided sufficient instructions. In a teaching situation, the teacher needs feedback from the learner on what they know and don't know. The language students avoided the interactive work required by claiming to know how to play. They were more interested in playing the game than helping to elicit the information from their peer. The peer teacher was, like the adult, someone

else to do the work, making it unnecessary for the learner to figure out what the goal of the game was or why a given procedure should be followed.

The Language students were also less likely to make good use of peer help when it was offered. The second strategy for avoiding peer instruction was to challenge the teacher's ability to teach almost before the teacher had an opportunity to explain the game. In this case, the learner, set on "not understanding," tried to establish adult help as the only way to learn the game. One way to understand this behavior is that the student in the role of learner may not want to be in a situation where his peer can out perform him. By challenging the peer teacher's ability to teach, the student removes the focus of attention from his own ability (or inability) to learn the games and focuses on his peer's ability (or inability) to teach. Children who have been set apart from their peers as learning disabled, are likely to have learned from experience not to acknowledge when and what they do not understand and how to restructure an event such that their performance is not the focus. It is likely that such revelations among their peers have often been more painful than productive.

Strategies for Avoiding Language as a Form of Mediation. While the Language students actively elicited adult help, the form of the help they sought was not verbal mediation. They did not commonly locate the source of their problem nor the kind of help that they needed. Instead, they used more general strategies for eliciting adult help. For example, they would request the adult join them in playing the game, or show them how to play, without specifying what they did and did not understand. Since the session procedures included the instruction to try to figure the game out themselves and only

request help when they could not understand some part of the task, general requests did not bring the kind of help that they needed. In these situations the adult either redirected them to the computer or to their peer teacher to figure the game out, or tried to get them to be verbally explicit about their needs. Their way of avoiding this request was to continue playing, selectively ignoring the questions of the researcher. In these situations, they were less likely to respond to elicitations or to produce the kind of back-channeling signals that indicate that they were listening to what was being said.

Their notion of adult help was not as an information source which provided verbal help. Instead they tried to appropriate the adult as a problem-solving tool that would do the work for them. After direct efforts to elicit help, they would become more passive waiting for the adult to do the problem-solving for them. Rather than problem-solving guidance, they were trying to rearrange the contextual situation so that the need to problem-solve vanishes. They did this by maintaining the presence of the adult while continuing to play aimlessly waiting for the adult to assess the problem and provide the solution.

As the language measures indicated, the dysphasic children had more trouble using language to convey information and share ideas. They did have strategies for getting through situations without making their difficulties overt. An example of peer interaction from the first cooperative session of Len and Bob demonstrates the use of such a strategy. In the first exposure to the "Harpoon" game, Len made some reasonable, but different, interpretations of the game world presented. He apparently did not understand the meaning of the

word "harpoon" but never acknowledged this to either Bob or the adult. He watched a sample game in which a moving arrow (harpoon) appeared above a line drawing labeled "OUR BOAT" and moved toward a solid triangle (shark fin) located at the center of two intersecting lines (radar). In the first display of the game screen the solid triangle had been labeled as "THE SHARK". Len interpreted the screen in a different way. He assumed the arrows were the sharks and that they were trying to "blow up" the thing in the center of the screen which he sometimes indicated as their location. While Len's interpretation of the goal of the game varied, at one time he stated it as "having the sharks get whatever the thing in the middle represented."

That a Language child would ignore literate clues and form a series of alternative interpretations is not particularly interesting in itself. What is interesting is the interaction between Len and his peer, Bob. Bob gave no indication of his perceptions of the game. He neither agreed or argued with anything Len asserted. Both students continued to initiate interaction while trying to learn how to play this game. Neither made any attempt to convince the other of his perspective. In fact, neither boy made any attempt during the game-playing phase to determine the other's interpretation of the game or to discuss how they might work together to figure out how to play the game.

When the adult came in to make sure that both students understood the game, she was not aware of Len's alternative understanding. When the first question that might reveal Len's alternative interpretation was asked, Bob quickly supplied a response that was consistent with the researcher's interpretation. This suggests that he had held this conventional view of the game despite Len's construction. While Len looked a little surprised by Bob's

response and the approval he received, he did nothing to indicate that he did not agree with this view or that he had entertained an alternative account. By not challenging or making evident different interpretations, the students are able to "pass" as having understood all along.

What is similar about all these strategies is that together they construct a situation that the Language students can manage. These students did not lack metacognitive skills of monitoring, checking evaluating, and planning, they were just employing them in a different way than the control students. In order for these skills to be used to solve the problems we had posed, some of these other issues would have to be minimized. A goal of the Training Study was to change the structure of the interaction to encourage the Language students to apply metacognitive strategies at the level of problem-framing.

The Results of the Training Study

The Training Study provided further evidence that these students did not lack metacognitive skills. With a minimal amount of training, the Language students were able to internalize strategies for game playing from the computer and strategies for teaching from an adult and apply them in the appropriate context. They also improved their problem solving social and language skills. A paper and pencil post-test demonstrated improved arithmetic skills. The training study also placed students in a situation where the goal they sought could best be accomplished if they cooperated with their peers. This required cooperation resulted in more language use then frequently accompanies classroom lessons. Students also monitored the performance of their peers, often reducing the need for adult supervision and

guidance.

This ability to benefit from instruction on a central part of the curriculum like arithmetic is a very positive finding, as it has important ramifications for designing educational programs for children with language problems.

EDUCATIONAL IMPLICATIONS AND CONCLUSIONS

A major educational issue that has been central to this work is the way that dysphasic children react to failures. The reluctance of these children to engage in a given task has been examined in light of their concerns for passing as normal. The first part of this section will discuss ways to use the skills that these children have displayed to draw them into educational experiences rather than allowing the children to find creative ways to avoid them. Another issue that is addressed is the consequences of grouping children with Language problems together for instruction. The final section discusses some ways in which small computers can be used to both promote social interaction and individualize the instruction of children in special education.

The Consequences of Failure

Inability to accomplish a task is not, in itself, a failure. It is only when a person or others observing that person define non-attainment as failure that it comes to have the consequences that are often associated with failure. Children in special education classrooms have come to know the consequences of failure. By not doing what they were expected to do they have been labeled

and segregated into small classrooms. Chances are that they do not have a good formulation of what it was that they did differently that led to this consequence. They do acquire some general formulation of their problem from parents, teachers and peers such as "not being very smart" or "having trouble learning how to read". These general formulations of the differences between themselves and their unlabeled peers often serve as guides to the kind of situations they will have to avoid in order to pass as normal.

The problem is that in trying hard to pass as normal, these children often "pass out" of important learning situations. If they aren't trying, then it is hard to determine whether or not they have the skill to accomplish a task. "Not trying" is only one of many ways to pass out of a learning situation. Several different kinds of avoiding strategies used by the children in this research have already been discussed.

The point is that these children work so hard at trying to hide their perceived inabilities, at passing, that they refuse the kind of help that is crucial if they are to learn. Because their formulations of their problems are often very broad, they avoid many situations in which they might have otherwise done well.

In addition, educational programs are not particularly sensitive to the problem of passing. Most of the knowledge imparted in schools is acquired through the medium of reading. If a child is actively avoiding reading, then he avoiding a great deal of what is he needs to learn in school.

There are two recommendations that follow from these observations. They are closely related and describe a system of interaction that focuses on the use of positive skills to overcome handicaps.

The first recommendation is to utilize a child's strengths to teach them knowledge. If a child is having trouble with reading and language, it is not necessary to make all forms of knowledge acquisition depend on reading skills. By decoupling reading from knowledge acquisition these children are likely to discover areas in which they do exceptionally well. Children labeled dysphasic generally do well on the kind of tasks that make up the performance scale of IQ tests. These skills are not systematically used to help design educational programs. Finding areas of expertise is important because it is easier to accept help in some areas if you are able to offer help in others.

This research has demonstrated that computers can be used to accomplish this educational goal. Educational software can be designed to provide exposure to a wide range of topics as well as simulations of important activities. It also can do so with a minimum reliance on text. As we have shown, computers can be programmed to interact with the ability level of the student so that they receive the kind of help they need. The confidence that children gain from doing well on some tasks will help provide the courage to undertake others.

The second recommendation is to redirect these children's metacognitive or passing skills from task avoidance to task analysis. To do this, the traditional structure of classroom lessons must be reorganized. Children need to be encouraged to help organize their lessons, to monitor their behavior, to check and evaluate their progress, to plan for the next activity. Current

educational programs for these children promote error-free learning of isolated skills. It is teacher structured and requires only the repetition of previously presented material by the student. A side effect of this method of education is that the children learn to fear wrong answers. If they do not know the correct answer or fear that they will not know an answer, then they work very hard to get out of the task altogether. They frequently succeed using disruptive behavior that is taken as further evidence of their learning problem.

One way to use what have been called metacognitive skills in the service of education is to have children evaluate their ability before they attempt each task. When the child faces a task, evaluates it as difficult, and then does poorly the child was right in an important way. The child should gain approval for this knowledge. "Being right" about the task being difficult, makes it possible to try a task in which one suspects they may not succeed without some of the negative consequences of failing. When the child is right about a task being difficult, then the source of the difficulty can be sought. Again the child can be a valuable informant on the nature of the difficulty. If the child does succeed in the task, then he or she was wrong about the evaluation yet gains approval for being able to do the task. This procedure will help the child to understand that being wrong is not something to be feared. In either case the child remains in the task, a necessary condition for learning. Just as in competitive races in which the winner if the one who can most accurately predict his or her running time, children could be rewarded for accurately monitoring their own progress. By utilizing these skills in the educational process, they are less likely to be used to subvert the process. It is also very important that these children develop an

accurate knowledge or their limitations as well as their strengths.

Teaching is made easier when the students can communicate their understanding of the material and the source of any confusion to their teacher. In order to learn, one must be willing to admit ignorance. Giving students an important role in the educational process may increase their courage span enabling them to risk revealing weaknesses so that they may then learn.

One way to understand the recommendation being made is to draw a comparison between physical and mental handicaps. Suppose a child comes out of an accident with a paralyzed leg. The prognosis is that the child might, by a series of exercises, be able to regain control of the leg. Now suppose further that this patient is put into an intensive program of physical therapy. In this program the whole body is held motionless so the patient can concentrate on trying to move the paralyzed leg. He is instructed to begin by trying to move only the toes. While the patient does make some progress in learning to wiggle his toes, he becomes frustrated by the slow progress. He comes to believe that he will never be able to move the leg. As treatment continues the rest of the body becomes so weak that it becomes increasingly more difficult for the child to stand up. In fact, the child comes to believe that he will never be able to walk and refuses to try. In this case we would be fairly sure that the paralysis is not spreading, and that the method of treatment is at fault for the degeneration of the child's physical skills.

It is not likely that such a program would have been designed for our imaginary patient. Instead, the kind of treatment that would be seen as most effective would be one that got the child to experience walking as soon as possible with whatever support was necessary to take the place of the

paralyzed leg. The child would be taught to walk focusing on the abilities that are under his command and would be helped to understand the extent of his handicap and ways to deal with it effectively. The use of a support system for the leg would not preclude efforts to help the child regain use of his leg while continuing to use the rest of his body. Instead, the child would work on moving the leg within the whole system of physical movement and not as a step by step program of isolated muscle contractions. The support system for the paralyzed leg would become more and more flexible as the patient regained control of the muscles.

How does this situation help us think about children with language problems? These children have had trouble acquiring language and learning to read. Like our physically-disabled patient the prognosis for the language-disabled student is unclear; the problem may go away with the right kind of "exercise" or it may not. The traditional approach by schools is to instigate an intensive language remediation program. In these programs the children receive concentrated individual instruction in language arts while other school subjects are dealt with only superficially in the belief that reading and writing are so basic that not much can be done until the children acquire these skills. Just as our patient had to begin his recovery by wiggling the toes, the language student has to begin by practicing sound-letter correspondence and decoding skills learned in sequence, because higher-order skills are dependent on them. These children, like our imaginary patient, get frustrated with their slow progress. They begin to believe that they will never read and refuse to try. Not only do they give up on reading, but, like our patient who gives up on walking, they stop all effort to learn when print is a part of the system.

There is an important difference in the causality inferences that are drawn from these parallel examples. In the example of the physically handicapped person it was the method of treatment that is immediately questioned when the patient failed to show progress. Learning problems of children in special education are rarely seen as a result of the method of treatment. Because we have such an unclear notion of what causes the difficulties in the first place, it is easy to locate the difficulties as a failure of the child. If the child does not learn under these conditions, it is taken as evidence of a more general learning problem. It is almost always the child rather than the treatment that is seen as the source of the difficulties.

Looking back to the method of treatment that seemed more appropriate for our imaginary patient, we can make some suggestions for effective educational programs. If the goal for the patient was to learn to walk with a paralyzed leg, the goal of these children would be to learn to engage in learning activities in which linguistic and literacy skills play and important role. They must be helped to read despite their linguistic or reading problems. Just as the patient needs support to begin walking, these children need support to participate in learning environments in school. They need to know that while they are having some difficulties with language and reading, they can learn. This means that knowledge acquisition must to some extent be decoupled from reading. Children need to be encouraged to use and develop all the skills they have to acquire knowledge. This <u>does not</u> mean that reading or language instruction are not important. It <u>does</u> mean that a different method needs to be used to teach these skills. Instead of breaking skills into isolated components each of which is meaningless by itself, our approach would be

to engage these children in the whole activity of learning in which reading plays a part. Within the whole system of learning these children will not be able to carry out all the tasks at the outset. They will need to be supported while they do as much as they can. As skill builds, so will self-confidence, and the children will be able to take over more and more aspects of the task until hopefully the support is no longer needed. In this way a "zone of proximal development" (Vygotsky, 1978) would be created for these children.

The question that remains is how to provide the kind of support that will help rather than cripple. A good model of how this is done comes from the analysis of the way that mothers teach their very young children to read (Ninio & Bruner, 1978). They don't start with a book of blank pages and teach the child to turn them one at a time. They start with a book that they will enjoy reading and help the child to participate in whatever way is possible. At first the mother does most of the work, reading the words, pointing to the pictures, asking the questions, and even providing the answers to these questions. The child's role at the beginning is very limited. When the child begins to point or make unintelligible responses, the mother encourages the child interpreting the responses. Slowly, as the child is able to take on more of the actions involved in reading, the mother takes a more and more passive role, providing encouragement and approval. But from the beginning the child has always been involved in the activity of reading with mother, and not simply getting ready to learn how to read.

This same model could be used with children with special problems. It would not require one to one interaction with an adult. Other children, as well as computer programs, could be used to help create a "zone for proximal

development" for these children. Learning environments in which children with language difficulties are able to contribute what they are capable of and observe what they need to learn, are likely to lead to skill development with less frustration than current approaches.

Educational Grouping of Children with Special Needs

The pattern of language errors and the high dependency of the dysphasic children on adult help suggests that the educational practice of grouping these children together in small numbers for instruction has some undesired consequences.

One problem with grouping children with language problems together is that the children are continually exposed to deviant language samples. Since language acquisition depends on exposure to language, grouping children with deviant language together may contribute to their problem because they do not get an opportunity to listen to good speech models from their peers. The errors listed for each of the children were very similar and in some cases the same incorrect phrases were used by different children.

Another effect of homogeneous grouping of children is that when difficulties arise with lessons, the children are less likely to be able to help one another. Thus, the dependency on adult help that was found in this research develops. It has been observed in other research studies that children with learning disabilities know what kinds of activities are likely to be difficult for them and develop strategies for dealing with these situations (Cole & Traupmann, 1980). For example, a learning disabled child, Adam, could not read very well. As a member of a cooking club he was able successfully to

hide his reading difficulties by working with a younger child who had a hard time carrying out directions. Together they are able to carry out a task that would be close to impossible for either one of them to carry out alone. By grouping children with specific problems together they are unable to get the kind of help they need from anyone but adults. It is possible that we have ignored the importance of informal learning that takes place when peers help one another. Homogeneous grouping of children may eliminate an effective channel of education, peer teaching.

The reason for grouping children together who had the same educational problems was so that they could be given more individual and small group help in the same areas. There are a number of ways of accomplishing these goals that do not have the negative consequences that have been described. One is to group children heterogeneously in the special education categories. In this configuration children with different skills could be used as peer experts to help other children learn. Yet the classes would remain small. Another solution is to provide for partial mainstreaming. This could be accomplished by flexible grouping of children for different subjects. An important component of these alternative groupings could be the utilization of small computers for instruction.

Computers and Education

One of the initial reactions that people have when computers are paired with education is to conjure up the stereotypical vision of a child sitting before a computer acting in an almost robot like fashion. This vision of a mechanical teacher scares those who believe that teaching is an intrinsically human enterprise.

While computers are extremely useful tools, they do not have a mind of their own. The children are not interacting with a machine. They are interaction with teachers and programmers in non real time (Black, Levin, Mehan & Quinn, 1982). Just as books enable students to interact with authors who are not co-present in the classroom, computers can enable to students to participate in lessons that are arranged prior to class time. Just as books are used by teachers and students to raise issues, provoke discussions and provide information, computers can be used in a similar fashion. But unlike books, computer programs can be tailored to adjust themselves to the level of the students, providing an important resource for teachers who work with students of differing abilities. Because computers can also be used as a communication medium between teachers and students and among students they can create more, not less, networks of interaction.

Our experience with computers and children during this research and the work of other researchers exploring the educational uses of computers (Levin & Kareev, 1980; Levin, Boruta & Vasconcellos, 1982; Quinsaat, 1981; Papert, 1981) has created a completely different image. Because computers are, and will continue for some time to be, a limited resource, children frequently work on computers in pairs or small groups. Together children discuss, propose and check responses to computer questions or problems. They help each other remember information regarding the form of interaction that is allowed and the location of keys on the keyboard. Frequently interactions which begin during computer work, continue after the children are no longer working on the computer.

Working together on computer games during the training study led to increases in joint problem solving that may have important consequences for cognitive development. Sharing the responsibility for failure as well as success seemed to help the children take the risks involved in trying hard to succeed. These findings and observation suggest that computers encourage, not inhibit, social interactions.

Conclusion

The children in the language group appear to have problems that cannot be said to be language problems alone. In other ways, they act less capable than other children. They may be mislabeled, but they are not misidentified.

They are children who need and can profit from educational assistance, but not of the kind that public schools are currently providing. Assisting them in their learning, rather than assisting them to learn what current theories say they should learn, appears to be the way to success, theirs and ours.

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