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ABSTRACT

An examination was conducted by a teacher who was interested in how the responses of three multihandicapped students (7-8 years old) differed in one-to-one and one-to-three instructional arrangements given (1) the physical limitations of the students; (2) an activity that demanded much physical prompting; and (3) limited instructional resources. Data were collected on the motoric responses made by each student during a 45 minute snack session. In the one-to-three arrangements, the teacher instructed the students concurrently. In the one-to-one arrangements, the teacher instructed each student consecutively. Thus, during the one-to-one arrangements, a student received one-to-one instruction for a portion of the 45 minute session and was wheeled to a free time area for the remaining portion. Results indicated that the students made more task-relevant responses and fewer counterproductive responses during the one-to-three arrangement than during the one-to-one arrangement when the data from the free time portions were included in the analysis. Discussion focused on the merits and limitations of one-to-one arrangements and the implications of these findings for the design of future research efforts. (Author/CL)

THE RELATIVE EFFECTIVENESS OF ONE-TO-ONE VERSUS ONE-TO-THREE INSTRUCTIONAL ARRANGEMENTS WITH SEVERELY MULTIHANDICAPPED STUDENTS[1]

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[1]Severely multihandicapped students are referred to here as those functioning within the intellectual range ascribed to the lowest functioning one percent of the population who also have pronounced motor, sensory, and/or health-related difficulties.

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ABSTRACT

Teachers are often confronted with instructional situations that force them to examine issues pertaining to the relative effectiveness of one-to-one and group instructional arrangements. Such an examination was conducted by a teacher who was interested in how the responses of three multihandicapped students differed in one-to-one and one-to-three arrangements given: a) the physical limitations of the students; b) an activity that demanded much physical prompting; and c) limited instructional resources. Data were collected on the motoric responses made by each student during a forty-five minute snack session. In the one-to-three arrangements, the teacher instructed the students concurrently. In the one-to-one arrangements, the teacher instructed each student consecutively. Thus, during the one-to-one arrangements, a student received one-to-one instruction for a portion of the forty-five minute session and was wheeled to a free time area for the remaining portion. Results indicated that the students made more task-relevant responses and fewer counterproductive responses during the one-to-three arrangement than during the one-to-one arrangement when the data from the free time portions were included in the analysis. Discussion focused on: a) the merits and limitations of one-to-one arrangements; and b) the implications of these findings for the design of future research efforts.

It is generally assumed that the more intellectually, motorially and sensorially handicapped a student, the more one-to-one instruction is necessary. Thus, when providing services to a severely multihandicapped student, resources are usually organized in ways to provide maximal amounts of one-to-one instruction. Some of the more specific reasons offered to justify a one-to-one staff-to-student instructional arrangement are presented below:

> To perform many meaningful tasks, a severely multihandicapped student requires frequent and intense physical manipulation, and consequently needs the undivided attention of a skilled professional.
>
> In the absence of reasonably developed observational learning and imitation skills, it is unlikely that a severely multihandicapped student will benefit substantially from instruction provided to other students. Thus a one-to-one arrangement is needed to ensure continuous, active responding to instructional cues.
>
> Many interfering self-stimulatory and other counterproductive actions can be minimized or prevented.
>
> Large numbers of direct instructional trials can be processed in relatively brief periods of time, allowing for more acquisition than otherwise would be realized.
>
> Teachers can focus precisely and intensively on individual needs.
>
> Many severely multihandicapped students manifest relatively long latencies and interresponse times. These latencies and interresponse times can be viewed as wasted time for those not receiving direct instruction. Why should three students do nothing while a teacher is waiting for one student with a long latency to respond to a particular cue? Could those students not be better engaged if one-to-one instruction was provided?

Surely one-to-one instruction offers opportunities to realize benefits that may not be realizable in small group instructional arrangements. However, excessive utilization of one-to-one instruction can engender many negative tangential effects which often neutralize gains realized. First, the typical class of six severely multihandicapped students is staffed with a teacher and an aide. This two to six ratio presents interesting problems to those relying primarily upon one-to-one instruction in that, at any point in time, only two of the six students can be receiving direct instruction. What habilitative activities are engaged in by the four who do not receive direct instruction? Unfortunately, severely multihandicapped students rarely behave constructively when allowed free time. Too many engage in counterproductive or antihabilitative actions such as body rocking and assuming inappropriate positions. Such maladaptive uses of free time cannot be tolerated, particularly since they often neutralize gains made during one-to-one instruction.

Second, a major purpose of an educational program is to prepare students to function as productively and as independently as possible in the widest possible variety of nonschool and postschool environments. How many nonschool and postschool environments offer direct one-to-one instruction or are appropriate for those who have learned to function only in response to one other person? Since very few environments afford such low ratio attention, efforts must be made to teach responding to information that is not only provided on an intensive and one-to-one basis.

Third, any school program must provide opportunities to engage in a wide variety of social interactions, particularly those that occur between students. Teaching someone to function primarily or only in a one-to-one instructional arrangement systematically minimizes opportunities to develop vitally needed student to student interaction skills.

Fourth, throughout life much information is secured from casually experiencing events that occur routinely in a variety of environments. When provided with the undivided attention of teachers, students often become overly dependent on instructional dues rather than those that are naturally available (Falvey, Brown, Lyon, Baumgart & Schroeder, 1980). Alternatively, when teachers are not readily available to anticipate and provide for specific needs, students may have more reasons to initiate actions in response to natural cues; e.g., to reach out for a cup voluntarily instead of relying upon a teacher to provide a cue to do so.

Fifth, when a one-to-one instructional arrangement predominates, there are few incentives for teachers, speech, physical and occupational therapists and other instructional personnel to expand their repertoires or to cultivate techniques appropriate for multistudent instructional arrangements. This, of course, seriously limits the effectiveness and versatility of instructional personnel and concomitantly inhibits generalized student growth.

Finally, several research teams have established that under certain conditions small group arrangements were at least as effective and efficient as one-to-one arrangements. Favell, Favell and McGimsey (1978) reported that severely handicapped students taught in a small group arrangement acquired word recognition skills as rapidly as those who received instruction in a one-to-one arrangement. Storm and Willis (1978) demonstrated that when motor imitation skills were taught to twelve profoundly retarded adults and when staff time was held constant, group instruction was as effective as one-to-one instruction. Alberto, Jobes, Sizemore and Doran (1980) examined the acquisition of receptive language, color discrimination and dressing skills by severely handicapped students in both one-to-one and small group arrangements. No statistically significant differences between group and one-to-one arrangements in the acquisition on the receptive language and color discrimination skills were reported.

An important characteristic of the aforementioned studies, as well as other research supportive of group instructional arrangements (Biberdorf & Pear, 1977; Fink & Sandall, 1980) is that the effectiveness measures were dependent on the ability of the participants to acquire and perform responses as a function of the modeling, verbal cueing and gesturing used during instruction. For many severely multihandicapped students, such indirect instructional techniques --- those that do not offer direct physical contact --- are not sufficient to engender the desired responses. Difficulties responding to indirect instructional techniques may be due to attentional, observational and incidental learning deficits, etc. However, they may also be due to motoric deficits. That is, a severely multihandicapped student may receive just as much information from the modeled, gestured and verbalized cues as nonphysically handicapped peers, but he may require physical prompting in order to communicate that information has been received and processed. For example, a severely multihandicapped student may reach for a brush after his teacher modeled the action of "brushing hair." For him this may be the only action he has to indicate an understanding that he should at least try to imitate his teacher. However, physical prompts may be required in order for him to perform the motoric actions necessary to grasp and utilize the brush appropriately. Thus to secure reasonable indices of acquisition, severely multihandicapped students must be afforded access to physical prompting procedures. Further, when issues related to the relative effectiveness of one-to-one and group instructional arrangements with students who rely primarily on physical prompting procedures to perform many actions are addressed, motoric functioning must be given substantial attention.

Undoubtedly teachers of severely multihandicapped students all over America are confronted with instructional situations that force them to contend with issues such as: The amount of one-to-one instruction that should be provided given limited instructional resources; the minutes per day a student should be left alone while others are receiving one-to-one instruction; and how maximal gains for all students can be realized. These were the exact issues confronting a teacher in the Madison Metropolitan School District during the 1981-82 school year. The remainder of this paper is devoted to trying to communicate how she addressed these extremely important but nevertheless complex issues.

THREE CASE STUDIES

Students

The three students selected were 7, 8 and 8 years old respectively. They were chosen on the basis of their consistent school attendance and the judgment that they represented the motoric and sensorial repertoires of the four other students in the class. Bev, a nonambulatory female, attended public school for five years during which time she lived at home with her biological parents and two older nonhandicapped brothers. Diagnoses included severe-profound mental retardation, spastic and athetoid quadriplegia. Phenobarbitol was taken for seizure activity and valium for spasticity. Bev had abnormal reflex patterns that interfered significantly with her ability to manipulate objects independently. Thus,

much physical prompting was required for her to perform the reaching, grasping and releasing responses required of many tasks. Furthermore, many physical and verbal interventions were necessary to inhibit inappropriate extension patterns. For communicative purposes, she was learning to make discriminative responses through directional eye movements. For example, to indicate where the soiled wash cloth belonged, she would respond to the cue "Show me where this (soiled laundry) goes" by orienting to and fixating upon the laundry basket.

Rick, a nonambulatory male, attended public school for five years during which time he lived at home with his biological parents and younger nonhandicapped brother and sister. Diagnoses included severe-profound mental retardation, microcephaly and spastic cerebral palsy. Phenobarbitol was taken for seizure activity. He essentially had no functional use of his left hand, but experienced significantly more control when responding with his right. A "raking" motion with a partially opened fist was used for a grasping response. Rick used a communication device which involved touching one of two photos displayed on a board. Use of the board was limited to those occasions when the teacher gave direct and specific cues within routine contexts.

Don, a nonambulatory male, attended public school for six years during which time he lived at home with his foster parents, brothers and sisters. Diagnoses included severe-profound mental retardation, hypotonicity, cerebral palsy, visual impairment and hydorcephaly. Dilantin was taken for seizure activity. Although he had minimal functioning in his left hand, he was able to use a palmer grasp with his right for object manipulation purposes. Additionally, he experienced difficulty releasing items in his grasp in a volitional manner. To communicate in routine contexts, he used a device which involved touching one of three photos displayed on a board.

One-to-One Versus One-to-Three Instructional Arrangements

As part of their daily routine, seven severely multihandicapped students received instruction on a sequence of skills necessary to participate in a snack activity. They were members of a class located in a regular elementary school and staffed by a teacher, an instructional aide and, on occasion, a practice teacher. Over a six month period, the teacher had used primarily two arrangements when providing instruction to three students during a forty-five minute snack activity: One-to-one and one-to-three. In the one-to-three arrangments, the teacher instructed three students concurrently in a series of forty-five minute sessions. In the one-to-one arrangements the teacher instructed each student consecutively. That is, for one portion of a forty-five minute session a student received direct one-to-one instruction and for the remaining portion he/she was wheeled to a free time area where a familiar toy or game was presented.

Typically, during the snack activity each student participated in preparing, drinking and cleaning up after a snack. The snack was a "smoothie" which is a drinkable blend of milk, fruit and yogurt. The

skills necessary to complete this activity are outlined in Table 1. As can be discerned from Table 1, the activity involved five major subactivities: Preparing the smoothie, drinking the smoothie, throwing away garbage, putting dirty dishes and utensils in a tub and placing soiled laundry in a basket. In order to perform each of the skills necessary to prepare a smoothie, many motoric responses were required. For example, performance of the skill, "Pouring the smoothie into a cup" required that the student:

Reach for the pitcher;
Lift the pitcher from the table;
Position the pitcher over a cup;
Rotate a forearm and shoulder in order to pour the contents into a cup;
Return the pitcher to the table; and
Release his/her grasp.

Given the physical limitations of the severely multihandicapped students in the class, independent performance of the skills necessary to "make a smoothie" would not have been a reasonable objective. Instead, they were expected to perform as many of the motoric actions as they could independently and then physically prompted through the others. It is important to note that none of the skills listed in Table 1 could be performed independently by the students and thus, to complete <u>each</u> skill some type of physical prompting was necessary.

The basic question of interest to this teacher was:

> How do the responses of my students differ in one-to-one or one-to-three arrangements given: a) the physical limitations of my students; b) an activity that demands much physical prompting; and c) limited instructional resources?

The procedure she used to answer this question was as follows:

<u>First</u>, she selected three students that were representative of the seven in her room. <u>Second</u>, she arranged for the students to be videotaped as they received one-to-one instruction during two sessions. While one student was receiving one-to-one instruction, the two remaining were wheeled to a free time area. The teacher and the aide recorded their performance while they functioned in the free time area. <u>Third</u>, the students were videotaped for five 45 minute sessions each while they received one-to-three instruction.

This procedure allowed the teacher to gather and analyze the following:

The motoric responses made by each student during the one-to-three arrangement;

Table 1

A Skill Sequence for Completing the Activity "Preparing a Smoothie"

Subactivity #1.	Preparing the Smoothie
	Select an item from an array of fruit, milk and yogurt
	Open the item
	Put a specified amount of the food item in a blender
	Repeat the above until a portion of each item is in the blender
	Turn on the blender[3]
	Stop the blender
	Pour the smoothie into a cup
Subactivity #2.	Drinking the Smoothie
	Bring cup to mouth
	Drink smoothie
	Set down cup
	Wipe face
	Repeat the above skills as necessary
Subactivity #3.	Throwing Away Garbage
	Pick up garbage item from table
	Position it over garbage can
	Release it into garbage can
	Repeat the above skills as necessary
Subactivity #4.	Putting Dirty Dishes and Utensils in a Tub
	Pick up dish or utensil
	Position over tub
	Release it into tub
	Repeat the above skills as necessary
Subactivity #5.	Placing Soiled Laundry in a Basket
	Pick up soiled cloth
	Position over basket
	Release it into tub
	Repeat the above skills as necessary

[3]This skill was performed with a "Rocking Lever Switch" (Holt, Buelon, Vanderheiden, 1976). The switch was activated by pressing one side of 4" x 1 1/2" panel which was mounted on a wooden box.

The motoric responses made by each student during the instructional portion of the one-to-one arrangement; and

The motoric responses made during the instructional portion of the one-to-one arrangement plus the responses made during the associated free time portion.

Response Measures

In all, 315 minutes of video taped and direct observational data were gathered; 90 minutes from the one-to-one sessions and 225 minutes from the one-to-three sessions. These data were examined for two types of responses: task-relevant responses and counterproductive responses.

Task-relevant responses. For the instructional sessions, a task-relevant response was defined as any attempt to perform the motoric action necessary to complete the skills involved in "preparing a Smoothie" as specified in Table 1. Since the students were unable to perform the skills independently, each discernible attempt was followed by some type of physical prompting by the teacher. For the free time sessions, task-relevant responses consisted of any motoric attempt to perform the actions necessary to play with a familiar toy or game. The specific motoric actions recorded during instructional and free time sessions included reaching, touching, grasping, lifting, moving, rotating a forearm and/or a shoulder, and releasing.

Counterproductive responses. The counterproductive responses recorded were a function of the teachers' knowledge of and experience with each student. Specific kinds and examples of counterproductive responses are:

Finger-flicking; e.g., moving fingers repeatedly in front of the face;

Inappropriate Manipulation of Materials; e.g., pushing materials off of a lap tray;

Inappropriate Extension Patterns; e.g., extending and maintaining arms and legs in a straight and rigid position; and

Tongue Thrusting; e.g., forcing tongue from mouth.

While response duration measures were not taken, it was required that one counterproductive response cease and that at least three seconds pass before another counterproductive response could be recorded.

Inter-Observer Agreement

Two observers recorded task-relevant and counterproductive responses during 12% of the one-to-one and one-to-three sessions. The total number of agreement minus disagreement was divided by the number of agreements and multiplied by 100, to convert to percentages. The percentage of agreement for task-relevant responses ranged from 91% to 100%, with a

mean of 94.8%. The percentage of agreement for counterproductive responses ranged from 80% to 100% with a mean of 97.57%.

Results

The information gathered by the teacher was organized so it could provide answers to three basic questions. The first question addressed was:

> How do the task-relevant responses made by each student differ under the conditions of one-to-one instruction-only; one-to-one instruction plus free time; and one-to-three instruction?

For comparability purposes, the data from all sessions were converted to a forty-five minute base. Thus the results described here represent the frequencies of task-relevant responses that one might expect if the duration of each condition was forty-five minutes. Descriptive data for the task-relevant responses are presented in Table 2. Inspection of Table 2 reveals that more task-relevant responses were made per forty-five minute session by all three students during the instructional portion of the one-to-one arrangement. However, the positive effects from the instructional portion were neutralized when the data from the free time sessions were factored in the analysis. When the teacher was held accountable for the frequency of task-relevant responses made during the entire time that the three students were in her charge, different results emerged. Specifically, the overall measures depicted in the third and fourth columns of Table 2, indicate that more task-relevant responses were actually made during the one-to-three arrangement when the comparison is made between that arrangement and the one-to-one sessions which included free time.

The second question addressed was:

> How do the counterproductive responses made by each student differ under the conditions of one-to-one instruction; one-to-one instruction plus free time; and one-to-three instruction?

Again, data from all sessions were converted to a forty-five base. In Table 3, the mean frequencies of counterproductive responses per forty-five minutes are displayed. Interestingly, Bev and Rick made the fewest counterproductive responses while functioning in a one-to-three arrangement, Don, on the other hand, made the fewest counterproductive responses during the instructional portion of the one-to-one arrangement. When the data from the free time sessions were included in the analysis, the counterproductive responses made during the one-to-one arrangement increased dramatically to a mean frequency per minute of 7.6 for Bev; 9.6 for Rick; and 22.0 for Don.

The third question addressed the issue of limited instructional resources. Since, it is rarely possible to provide one-to-one instruction to all students at one time, the benefits of this arrangement can not be

TABLE 2

Mean Frequencies of Task-Relevant Responses
Converted to Using a Forty-Five Minute Base

	One-to-One		One-to-Three
Students	Instructional Portion Only	Instructional Portion Plus Free Time	
Bev	72.0	18.9	28.4
Rick	80.1	31.0	36.4
Don	53.1	27.4	45.0

TABLE 3

Mean Frequencies of Counterproductive Responses
Converted to Using a Forty-Five Minute Base

Students	One-to-One		One-to-Three
	Instructional Portion Only	Instructional Portion Plus Free Time	
Bev	1.4	7.6	.60
Rick	5.8	9.0	1.40
Don	3.6	22.0	4.50

viewed independently of actions made while a student waits for his/her turn. Thus, the condition of one-to-one instruction only was omitted from the analysis. Specifically, the third question was:

> Given limited instructional resources, how do task-relevant and counterproductive responses differ under two instructional arrangements: one-to-one plus free time and one-to-three?

By ways of comparison, a graphic display of the results discussed thus far is presented in Figure 1. These results indicate that the students made more task relevant responses and fewer counterproductive responses during the one-to-three arrangement than during the one-to-one arrangement which included free time.

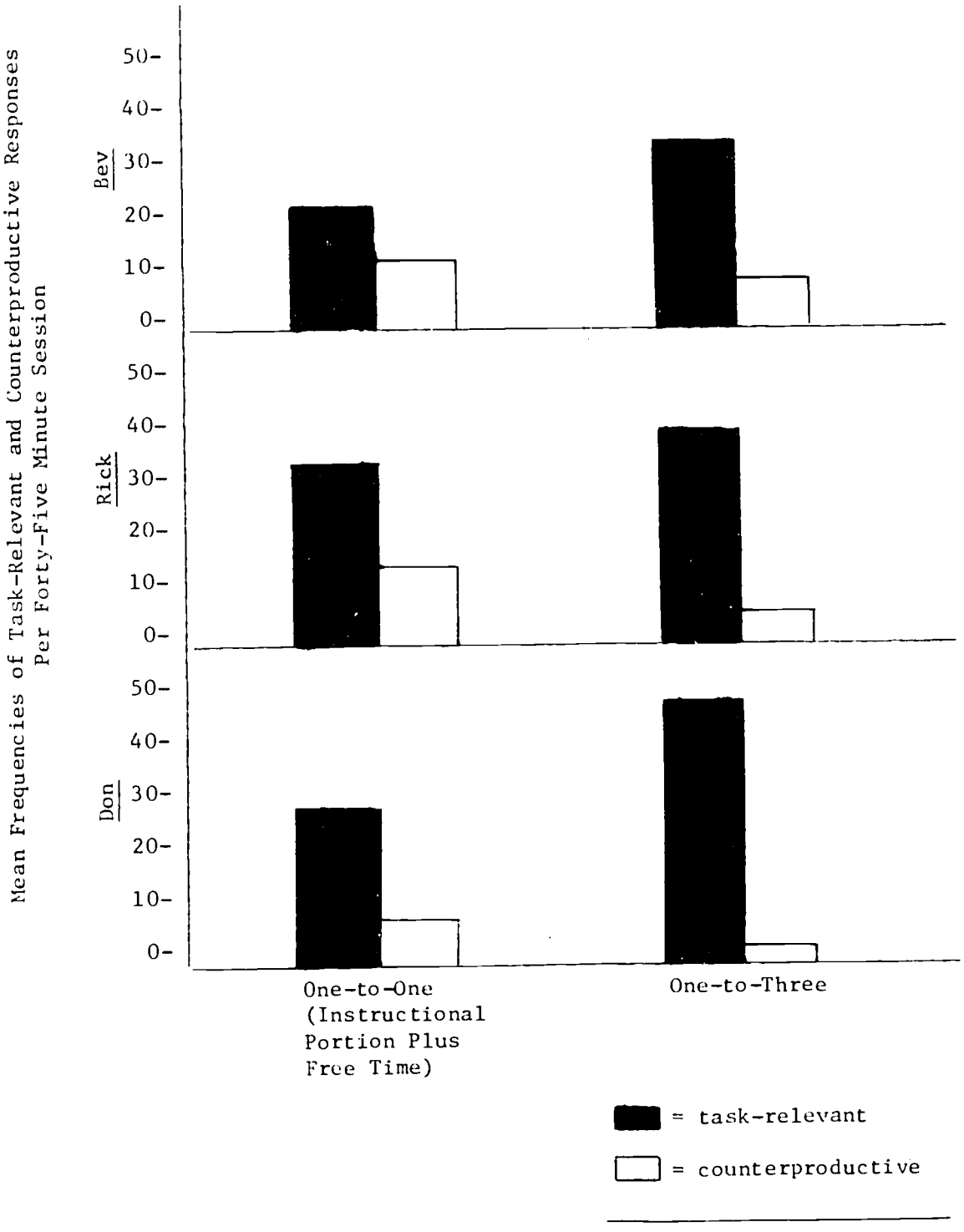

Figure 1. A comparison of the frequencies of task-relevant and counterproductive responses made during one-to-one (instructional portion plus free time) and one-to-three instruction per forty-five minute sesion.

DISCUSSION

Indeed, the results can be interpreted as suggestive that severely multihandicapped students made more task-relevant responses during the instructional portions of one-to-one sessions than during the one-to-three sessions. however, before this statement is viewed as unequivocally supportive of one-to-one instructional arrangements, an extremely important point must be made. Few classrooms are provided with sufficient staff to allow one-to-one instruction for all students at all times. If providing one-to-one instruction results in the allotment of free time to those who have not yet learned or who do not perform the skills necessary to occupy this time in constructive ways, one can reasonably expect that the positive effects of one-to-one instruction will be neutralized by the counterproductive actions made during "free time." This is precisely the situation presented here. The positive effects of the one-to-one instruction were neutralized when the data from the free time sessions were included in the analysis. In fact, the three students actually made more task-relevant and less counterproductive responses in the one-to-three sessions than the one-to-one when the teacher was held accountable for the free time data.

If a school system could afford one-to-one instruction for an entire day, should it be utilized? In the judgment of this teacher it should not for at least two reasons. First, one-to-one instruction did not allow for student to student interactions, but one-to-three instruction did. For example, while one student was taking a turn pouring milk, the teacher was able to involve another student by having him/her hold the cup. Second, during the one-to-three instructional arrangement more initiating responses were made. Perhaps in the absence of the undivided attention of the teacher, students had more "reasons" to initiate a response. For example: At one point during the snack session, Don's cup was not within his reach. As the teacher worked with another member of the group, Don reached for the cup unsuccessfully. A few seconds later he made the same response. Although on the second occasion he managed to tip over his cup, his initiation of a response in the absence of direct teacher attention was viewed positively.

As with many severely multihandicapped students, each of the three students involved here required direct physical prompting in order to make complete, task-relevant responses. Obviously, when three severely multihandicapped students are grouped together, the number of occasions upon which they can respond simultaneously is limited. Would not instruction be enhanced if at least one student in the group did not have severe motoric difficulties and thus could respond to input of a non-physical nature? In light of the learning and performance characteristics of a severely multihandicapped student a classroom full of students similarly situated must be seriously questioned. A more heterogeneous mixture might be more educationally efficacious.

Finally, this paper can only be viewed as an empirical report of how one teacher addressed the problem of trying to decide the instructional

arrangement she should use with the severely multihandicapped students in her classroom. However, her findings do have interesting implications and do offer several important challenges to researchers. Some of the questions that might be addressed in more controlled analyses are:

How does a teacher determine the appropriate balance between one-to-one and other types of instructional arrangements for an individual;

How can one generate strategies that can be utilized to maximize learning in other than a one-to-one arrangement;

What are the strategies that can be utilized to elicit responses to natural cues in one-to-one and small group arrangements; and

Can strategies that ensure student to student interactions in small group arrangements be developed.

Hopefully, future research will result in information that can be used to arrive at affirmative educational decisions and solutions to such questions.

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