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HOW DO PRESCHOOL TEACHERS' REQUESTS INFLUENCE CHILDREN'S BEHAVIORS?

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Abstract—This research is based upon the mediating process paradigm (Doyle, 1986), which assumes that only part of the behavior of teachers influences the classroom behavior of children. Children filter and interpret the teachers' behaviors, so that pupil reactions do not always correspond with those expected by teachers. Six preschool teachers were observed three times in each of two settings in which children played with two different sets of physical objects. The behaviors of students and teachers were recorded with a functional coding system. Teacher requests were classified as effective or ineffective depending on whether they were followed by the expected pupil behaviors. These analyses showed that only 58% of teacher behaviors were effective. Further analyses of the data showed that the more cognitively complex were the demands placed upon children, the greater was the chance of ineffectiveness. Detailed sequential analyses of selected requests indicated that their effectiveness was dependent on the interactive context in which they occurred.

In process–product research, all teacher behaviors are taken into account, almost as if everything teachers say and do influences students in the described way. But this postulate, on which process–product researches are based, has never been confirmed.

In his famous paper, *Paradigms of Research on Teachers' Effectiveness*, Doyle (1979) emphasized how, in process–product research, the learner's role is undervalued. The student is considered to be a simple receptor of information communicated by the teacher. The teaching process is reduced to an input→output equation.

Doyle suggested abandoning the process–product paradigm for the *mediating process paradigm*. In this paradigm, the teacher is still considered to be the determining agent of the class, but it is assumed that the teacher's input is treated (i.e., filtered or transformed) by the student. In this way, the students play an equal determining role since it is they who decide which instructional stimuli will be treated, how they will be treated, and finally, which elements of teaching will be retained.

It, thus, is essential to establish a distinction between *nominal stimuli* and *effective stimuli*. Nominal stimuli are all the teaching elements organized by the teacher that can be objectively observed. Effective stimuli are the teaching elements that affect the children, that which remains of the nominal stimuli when they have been filtered and transformed by the students.

For those who hold to Doyle's concept, the postulate on which process–product research is based, is not longer tenable. On the contrary, an opposing hypothesis merits support and research: *A more or less important part of teacher behavior does not affect children in the way the teacher intends*. Further concerning students' learning, the most definitive indicator is not what the teacher says, but what the student retains of what the teacher says.

A new problem automatically emerges from this way of looking at the situation: *It is no*

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longer adequate to observe what the teacher says and does; it is essential to determine what part of teacher behavior really affects the student. That is the first objective of the research we present below.

The second goal of this research is explanatory. It involves not only assessing which part of the nominal stimuli exerts an effective influence on the students, but also *understanding why teacher behaviors hold students' attention at certain times and not at others, and when these differences take place*. Among the possible explanatory hypotheses, two are noteworthy:

1. The more teacher behavior calls for an elaborated cognitive process, the greater the risk that the student will not deal with, or will deal poorly with, this stimulus.
2. The probability of teacher behavior holding the attention of the student concerned depends on the conditions in which this behavior is carried out. For example, some moments in the interactive sequence are more opportune than others to communicate a request to a child.

Method

The Need for a Genuine Functional System to Categorize Teacher Behavior

There are traditionally two ways of categorizing behavior, depending on whether the category definition specifies the behavioral form (formal description) or the function that is the result the behavior is expected to produce (functional description). Most teacher observation instruments are of the second type: The behaviors are classed according to the pedagogical function they are supposed to fill. In other words, these instruments accept the principle that teachers are pursuing a goal each time they behave in a certain manner towards a child.

In these cases, the coding technique consists of attributing a function to each observed behavior. It is generally hypothesized that the *function* assigned by the observer corresponds effectively to the *function* carried out by the teacher, that is, to the result sought by the teacher. To doubt this relationship is to question the validity of the instrument used.

"Does the teacher produce the sought-after result in the student?" is a question which concerns another type of relationship, one which must exist between the function carried out by the teacher and that assumed or produced in the student (cf. Figure 1). This is the second type of relationship that we will be concerned with.

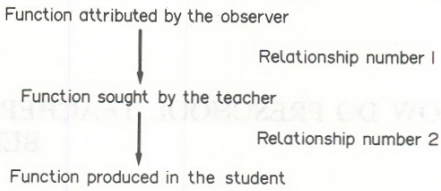


Figure 1. Relationships between functions of behavior.

It is important, however, to first identify a categorization instrument by which the functions sought by the teacher can be identified. This instrument must be valid, but since all those available in the scientific field claim to be valid, it is difficult to choose which to use.

In most systems, the functions often present a general and interpretative aspect which makes identification of the function produced in the student difficult. These faults are related, on the one hand, to developers' desires to make instruments applicable to all pedagogical situations and, on the other hand, to the instruments' procedures and even their construction. The established distinctions result for the most part in an *à priori* conception of what good teaching is. In this way, these systems convey more or less explicitly an educational ideology (cf. Flanders' system).

A genuinely functional categorization system must distinguish interactive behavior according to the type of behavioral result the speaker intends (Hinde, 1966). We have tried to create this type of system in order to analyze the behavior of preschool teachers in the course of activities related to physical knowledge (Crahay, 1983; Kamii & Devries, 1978).

Description of the Systems of Categories

No existing instrument presented the characteristics that we required. Therefore, an attempt has been made to create this type of system in order to analyze the behavior of preschool teachers and of the children in the course of activities related to physical knowledge (Crahay,

1983; Kammii & Devries, 1978). The aim was to devise a coding system by which teachers' and children's behaviors could be analyzed with the same behavioral categories.

In these physical activities, a group of various objects was made available to children to manipulate, assemble, fit together, stack, and fill with various things. In brief, the child's action was important.

In a preliminary phase, the teacher−child interactions that took place during these activities were observed. Then, a list of children's behaviors brought about by the teacher's or by another child's attempts was drawn up. The teacher's or child's behavior in this type of situation was distinguished depending on whether they were trying to: (a) make the child act in relation to the physical objects, (b) make the child speak, (c) interrupt a child's behavior, (d) change the orientation of a child's attention.

In some cases, the teacher or the child seemed to expect no direct response to his/her behavior.

When the observer assumes that the teacher or the child expects a direct overt response to his/her behavior, this action is named a solicitation (Bellack, Hyman, Smith, & Kliebard, 1966) or a request. When the observer assumes that the teacher or the child expects no direct overt response to his/her behavior, this one is named a comment. Four generic categories of solicitations have been distinguished: (a) solicitation of an action on objects, (b) solicitation of a verbal behavior, (c) solicitation of a change in the eyes' orientation, (d) solicitation of an interruption of behavior.

Each of these four generic categories has been divided into sub-categories according to the kind of action or verbal behavior that the teacher or child is presumably attempting to elicit.

Some behaviors have no meaning if we do not look at the interactive events which precede them. This kind of interactive event constitutes, according to Bellack et al. (1966), a reaction. When a child refuses a teacher's request, or when a teacher approves a child's statement, they react. The important feature here is *the relationship of necessity* which exists between the teaching act and the event which precedes it. In an interactive sequence, any behavior has an antecedent. But, for some interactive behaviors, there is no logical necessity for their being preceded by a specific type of event. For example, it is possible to request an action from a child regardless of what the child was doing before. Probably, if the child had been involved in an interesting activity, he or she would ignore or respond negatively to this request. Nevertheless, a solicitation can be carried out by the teacher in this context. In the other case (reactions), an approval, or a refusal, or an evaluation could not be emitted by the subject if no behavior of the interlocutor were carried out before. In other words, some behaviors *need* a specific antecedent before they can be emitted; others *can* be emitted whatever is happening in the classroom. Further, the specific antecedent which is the logical condition for the emission of some behaviors can be an action or a verbal behavior.

In summary, teachers' and childrens' behavior can be categorized according to two axes:

1. The axis of the antecedents which can be divided into three parts:

—the behavior can be emitted without any specific antecedent;

—an action is required as a logical condition of the emission of the behavior;

—a verbal behavior is required as a logical condition of the emission of the behavior.

2. The axis of the intended consequent, which can be divided into five parts (no overt teacher/child's response is sought by the teacher/child, physical action, verbal conduct, interruption of behavior, change in eyes' orientation).

It should be noted that some teacher/child behavior is both reaction and request. This is the case, for example, when a teacher reacts to a child's action by asking the child to verbally describe what he or she has just accomplished or when a teacher reacts to a child who is involved in a project (''You could take a ride with those wheels'') and invites the child to take part in the action. This is also the case when a child requests details from the teacher after a previous solicitation. Thus, it is necessary to combine the two axes.

This consolidation of the two axes produces a table of 15 cases, of which one is impossible. We thus obtain 14 functional categories which are presented in Table 1. Categories B and C

Table 1

Functional Categorization System of Teacher–Child (and Child–Child) Interactions During Activity with Object

Prior activity	No specific result expected	Expected result is action on object	Expected result is verbal	Expected result is change in eyes' orientation	Expected result is interruption of behavior
No specific prior event	A. Transmission of information —describe the characteristics of an object —Relate a personal experience or an event unrelated to the current activity	B. Request for a child's action —Request an undetermined action —Request a determined action —Request that the child produce an effect with an object	C. Request a child's verbal conduct —Request the description of an object —Request information related to the object —Request the relating of a personal experience —Request planning of a project	D. Draw attention to an object	
Specific prior event is action on object	E. React to an action —Describe the reaction of an object to a child's action —Enunciate a dependent relationship between the reaction of the object and a child's action —Evaluate a child's action positively —Evaluate a child's action negatively	F. Request the prolongation or the transformation of a child's action —Encourage the continuation of an action —Request a correction of an action —Request the repetition of an action —Request the imitation of a school-mate's action —Request the amplification of an action	G. Request a verbalization regarding the action —Request the enunciation of a dependent relationship between the action and the reaction of the object —Request a description of the object's response —Request a description of the action taken	H. Draw attention to child's or others' actions	I. Request an interruption of action

Table 1 (continued)

Specific prior event is verbal conduct	J. Reaction to a child's verbal conduct —Refuse a request or a project —Repeat while correction —Note agreement —Enunciate a prediction related to an action	K. Request or accept the carrying out or completion of a project —Invite to take part in the action —Accept a request of action	L. Request the development of or verbal conduct —Request details —Request a prediction as to the object's response —Request a prediction of the action needed to produce an effect —Request the repetition of a verbal conduct	M. Draw attention to verbal conduct	N. Request interruption of verbal conduct

behaviors generally *initiate* the teacher/child interaction, while categories E and J are generally behaviors that end the interaction (produce ''closure''). Categories F, G, K, and L are those behaviors that aim to *extend* the interaction by amplifying the teacher's or child's response.

Each functional category is composed of a variable number of teacher or child behaviors. Table 1 presents a few examples for most categories.

Description of the Research

Six teachers of the third preschool year (4- and 5-year-olds) were observed in the course of six activities with objects. In three of them, the children played with rolling pins, wooden boards, and mobiles (balls, small cars, billiard balls). In the other three, the children arranged containers, funnels, tubes, balls, and a container of water. These organized activities took place during a ''workshop'' period in which the children chose one activity among many possibilities and worked in small groups in an area reserved for that chosen activity.

During the activities observed and analyzed here, there were five children in each group. Each observation period lasted 20 minutes. The observation period with the first set of equipment (Setting 1) alternated with those in which the second set of equipment (Setting 2) was available, according to a random rotation format. Table 2 illustrates the set-up of this experiment.

The analyses therefore involved six teachers for three 20-minute periods in each of two settings giving a total of 12 hours of observation.

All observations took place in the afternoon between 1:30 and 3:00 p.m. The coding was conducted by three associates unfamiliar with the details of our hypotheses.

The training received by the three observers is summarized below.

Step 1: Coding of written protocols. Minimum level of agreement (with the codes of the two main researchers required: .90.)

Step 2: Transcription of video recordings of activities.

2.1. The observers could use the review material as frequently as required.

2.2. The observers could use the review material only once per segment of activity.

Table 2

Structure of Sample of Observations: Number of Pupils per Observation Session

	Setting 1 Activities with equipment 1: rolling pins and boards			Setting 2 Activities with equipment 2: container of water		
	Period 1	Period 2	Period 3	Period 1	Period 2	Period 3
Teacher 1	5	5	5	5	5	5
Teacher 2	5	5	5	5	5	5
Teacher 3	5	5	5	5	5	5
Teacher 4	5	5	5	5	5	5
Teacher 5	5	5	5	5	5	5
Teacher 6	5	5	5	5	5	5

2.3. The observers could not use the review material.

(The number of actions and interactive behaviors transcribed was counted and compared to the number obtained by the two main researchers. Level of agreement required: .90.)

Step 3: Observation of activities by group of three observers (one of the two main researchers and two observers) in natural settings.

The transcriptions were compared. The actions and interactive behaviors were counted. This kind of exercise was repeated as frequently as needed until the level of .85 agreement was reached.

During the experimental phase, a part of the transcription of each observer was recoded by one of the main researchers. It was decided that if the level of agreement between codings was under .90, all the transcriptions would have to be coded by two persons. It did not happen.

A repertoire of all the actions possible in both situations existed from previous research (Crahay, 1983). During the pre-experimental phase, the observers were trained to identify the children's actions by reference to this repertoire. This repertoire is organized in a hierarchical structure in which each action receives a code.

Results

Descriptive Analysis of Results

Researchers who observe teachers in teaching settings or classroom periods usually look at the distribution of behavior in the different categories of the system used, then establish a behavioral profile for each teacher or for a group of teachers. The data collected in the course of this research can be processed in this way, as Table 3 shows.

The analysis of variance (the results of which are not included herein) shows that the frequency of most of the behavioral categories varies considerably from one teacher to another and from one setting to another (water play versus rolling pin). On the other hand, the frequency of the different behavioral categories varies little for the same teacher from one period to another.

We will not try here to characterize these 12 teachers, or to design a profile corresponding to each teacher. That is not the purpose of this article.

Analysis of the Immediate Effect of Teacher Conduct

The question posed at the start of this research was of another order: How to determine which types of teacher behavior affect the student in the desired sense or to discover the relationship between the function exercised by the teacher while addressing the child and the function produced in the student. For the 4318 observed behaviors coded with the functional categorization system discussed above, we can identify the function carried out or attempted by the teachers each time they acted. Determining whether each of the behaviors fulfils the

Table 3

Distribution (in percentages) of Observed Behaviors by Category for Each of Six Teachers in Two Settings

Identification of teacher	T1		T2		T3		T4		T5		T6		Average rate	
Behavioral categories	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
A. Transmission of information	5.6	4.3	1.9	6.4	4.7	14.4	9.2	9.8	29.0	11.2	3.5	5.4	8.2	8.4
B. Request for action	12	5.7	10.3	5.0	3.8	4.8	6.7	7.2	3.6	3.3	10.5	6.9	7.4	5.5
C. Request for child's verbal conduct	0	1.6	3.6	7.2	2.5	1.5	3.7	1.2	1.1	2.6	4.7	5.4	2.9	3.6
D. Drawing attention to an object	0	0	0	1.4	0	0	0	0.4	0.3	2.6	0	0.3	0.5	0.7
E. Reaction to child's physical action	17.7	15.1	20.7	18.9	13.5	10.2	11.3	17.0	23.1	18.1	20.9	14.3	17.8	15.2
F. Request aimed at prolonging or transforming a child's action	15.8	6.5	5.3	4.4	8.6	5.0	7.5	19.9	12.5	6.9	5.9	7.7	8.5	6.6
G. Request for verbalization of physical action	17	35.9	28.5	26.4	32.5	36.8	25.3	21.3	9.9	26.0	23.6	27.9	24.4	29.9
H. Drawing attention to an action	0	2.4	0.8	4.6	1.5	4.0	1.6	3.8	3.6	3.3	0.8	2.8	1.4	3.5
I. Request interruption of a child's physical action	4.4	1.4	1.6	0.2	0.2	1.5	1.2	0	1.8	0.9	2.3	1.1	1.6	1.0
J. Reaction to verbal conduct	8.2	16.3	14.5	13.1	12.2	9.6	18.1	13.2	7.3	15.5	12.5	20.5	12.4	14.8
K. Invitation to put the verbal conduct into practice	4.4	5.0	4.4	3.6	6.2	1.7	1.6	2.5	0.8	1.3	7.4	1.6	4.5	2.6
L. Request aimed at prolonging or transforming verbal conduct	11.3	3.6	5	6.6	12.5	9.0	9.2	10.2	2.9	7.2	6.2	5.0	7.9	6.7
M. Drawing attention to verbal conduct	0	0	0.2	0	0	0	0	0	1.8	0.3	0	0	0.3	0.0
N. Seeking an interruption of verbal conduct	3.1	1.6	2.5	1.6	1.2	1.1	3.7	0.8	1.8	0.3	0.8	0.3	20	0.9
Total frequency of observed behaviors	158	415	357	495	464	519	237	234	272	303	334	52	1822	2496

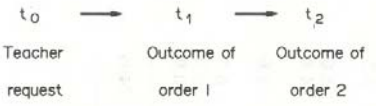


Figure 2. Steps in behavioral sequence.

carried-out function using this system — in which each code defines the expected outcome — is easy: We need only find out whether the child behavior that followed the teacher behavior coincided with that given in the code definition. To be even more sure, we will also take into consideration the time 2 behavior, where the teacher's request is considered as time 0 in the sequence. In technical terms, we will examine the results of the first and second orders.

This examination is applicable only to solicitations (categories B, C, D, F, G, H, I, K, L, M, and N). This excludes from further analysis categories A, E, and J.

Using this simple technique, we can:

1. Determine for each teacher behavior whether it produces the sought-after effect — in other words, if it is effective.

2. Calculate for each type of teacher behavior in categories G, C, D, F, G, H, I, K, L, M, and N the proportion of effective behaviors.

3. Calculate for each teacher the proportion of effective behaviors for each category.

Table 4 provides, for each teacher and each setting, the proportion of effective requests in each category.

A reading of this table is enlightening. Note, in particular, that an average of four requests in 10 did not produce the effect anticipated by the teachers. This rate varies, moreover, from one teacher to another. Close to half of the requests made by teacher 3 in setting 2 did not produce the desired effect. On the other hand, teacher 5 appears more effective: The requests produced the desired effect three times out of four.

Graphs 1 to 5 in Figure 3 allow us to visualize the gap which can widen between the number of behaviors exhibited by the teacher and the number of teacher behaviors that affect children in the expected manner.

That the proportion of effective behaviors varied from one teacher to another probably will not surprise many people. This result will only confirm that there are good and bad teachers. However, the situation is more complex than that. Two factors should be taken into consideration in this first conclusion.

1. The data show that the proportion of effective behaviors was generally higher in setting 2 than in setting 1.

The setting, that is the characteristics of the equipment made available to the children as well as their distribution in the space, affected the effectiveness rate of requests. Generally speaking, the probability that a request would be successful was greater when it was addressed to the children playing with the container of water. The explanation is probably simple. In this setting, the children were grouped in a small area playing with equipment less noisy than the rolling pins and boards: These situational characteristics make us think that there were few interferences to communication in this setting. This result allows us to note the significance of contextual factors in the teaching process.

2. With all the teachers, certain types of teacher behavior were more effective than others. Thus, when teachers requested that behavior be interrupted (categories I and N) or that children change their eyes' orientation (category H), they very often obtained the desired result. For category I, the average proportions of effective behavior are respectively .78 (setting 1) and .75 (setting 2). For category N, they are .97 and 1.00, and for category H are .77 and .81. Also, when teachers invited the children to carry out the action they had just described (category K), the probability that the child would respond favourably was even higher. Eighty-one percent of the requests in setting 1 and 92% of those in setting 2 were effective.

On the other hand, when the teachers requested an action (category B) or the verbalization of a physical action (category G), they obtained the desired result less frequently. The average proportions of effective behaviors for category B are .40 and .53; for category G, they are .48 and .55. From a Piagetian viewpoint (Crahay, 1983), these two types of teacher behavior are the most propitious in stimulating children's progress. But it serves no purpose to express regrets about these observed results, we must attempt to understand them.

In the light of the preceding discussion, we hold that the nature of the request behavior has an influence on the chances of the request's success. More precisely, it seems that when teachers request a simple behavior (changing the eyes' orientation, interrupting behavior, carrying out what has just been described), success is assured or almost assured. On the other hand, when they demand more complex performances (carrying out an action likely to produce a certain effect, explaining how to succeed at a certain project), children are more likely to avoid or refuse the requests. We will, therefore, hypothesize that the more a request calls for a response that demands of the child an elaborate cognitive process, the more numerous are its chances of being ineffective. We turn now to the test of this hypothesis.

Analysis of the Effectiveness of Requests as a Function of the Nature of the Expected Response

If the hypothesis that we have just posed is true, it should prove correct whenever the requests within a category are ordered as a function of the complexity of the expected response. We will verify this for the following categories:

1. Action request (category B).
2. Requests aimed at prolonging or transforming an action (category F).
3. Requests for verbalization regarding an action (category G).

Active requests (category B). When the requested behavior is an action, the request can either specify exactly the nature of the action to be carried out or not do so. In the latter case, the teacher mentions only the object with which the action should take place and does not specify the nature of the behavior the child has to produce. This type of request constitutes an *undertermined action request*. We predict that, at the conclusion of this kind of request, the child will carry out an action he or she has mastered previously. Consequently, the effectiveness rate of this type of teacher conduct should be high.

A second type of action request (*the determined action request*) consists not only of specifying the object which the action will use, but also the nature of the action to be carried out. Here, the child has less freedom to choose the action to carry out. The rate of effectiveness of this request will in all likelihood be inferior to that of the undetermined action request.

In the third type of action request, teachers invite the children to produce through their actions a given result without specifying the nature of the action to be carried out. In this case, they make a *produced effect request* and in doing so, pose a problem for the children, to find or devise the appropriate action. The effectiveness rate of produced effect requests will probably be inferior to those of the other two types of action requests.

Table 5 provides the rate of effectiveness and the frequency of appearance of these three action requests for each teacher. It also provides a total index on which we will base our conclusions. As can be seen, the data corroborate the hypothesis.

Requests aimed at prolonging or transforming an action. Among the requests aimed at prolonging or transforming an action (category F), there are the following sub-categories:

1. Request to imitate an action carried out by a peer.
2. Request to continue action.
3. Request to repeat an action which has just been carried out.
4. Request to correct an action.
5. Request to amplify a result.

The first three requests do not require productive thinking on the child's part. On the other hand, correcting an action or amplifying a result (building a taller building) requires a child to carry out a more complex action. We therefore hypothesize that these last two requests have lower effectiveness rates than the first three.

Data presented in Table 6 confirm this hypothesis.

Category G is principally composed of requests aimed at making children talk about what they have done with the objects. Three sub-categories of these requests have been identified:

1. Request for description of object's reaction.
2. Request for action.
3. Request to enunciate a relationship.

In the first category, the teacher invites a child to describe the result of his or her action, or, in more technical terms, the teacher asks for

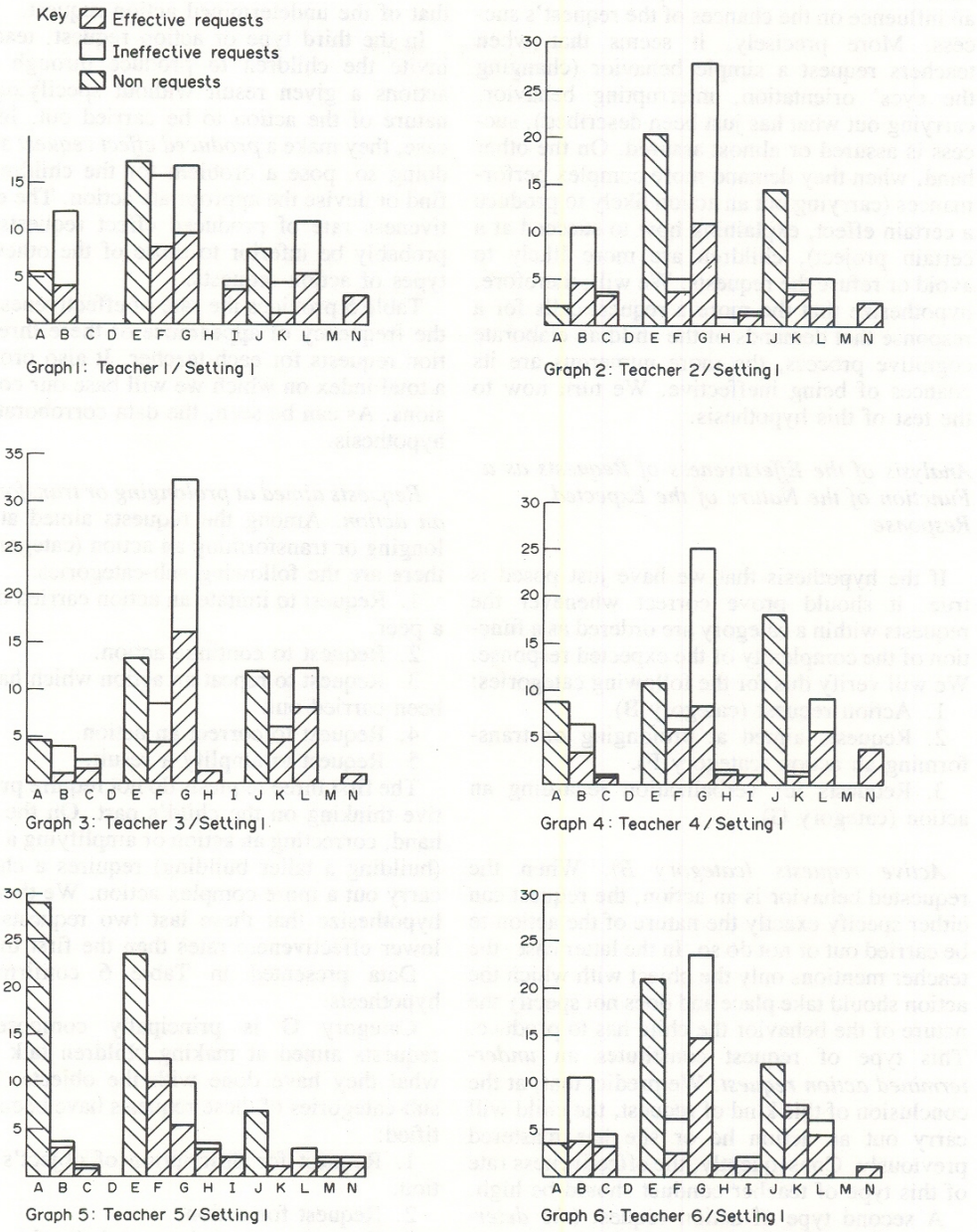
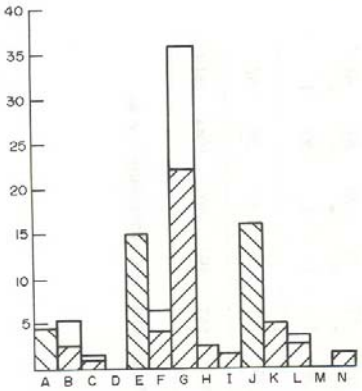
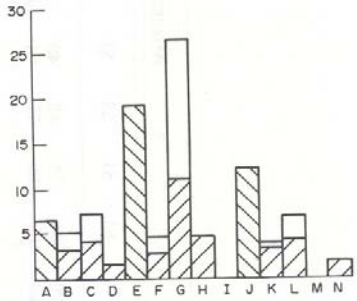


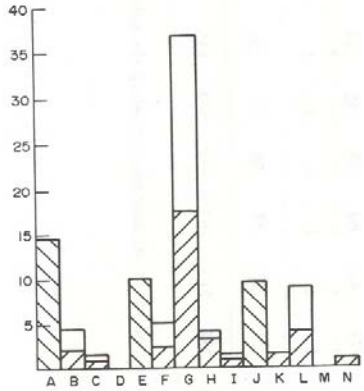
Figure 3. Relationships between the number of behaviors exhibited by the teachers (1−6) in both settings (1 and 2) and the number of teacher requests that affect children in the expected manner.



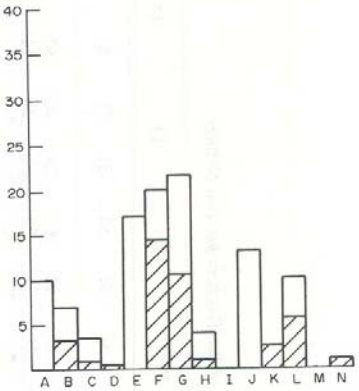
Graph 7: Teacher 1/Setting 2



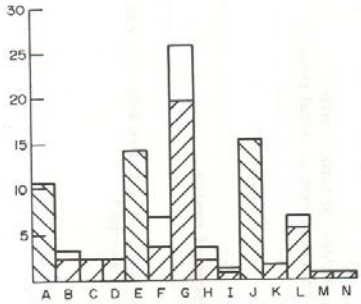
Graph 8: Teacher 2/Setting 2



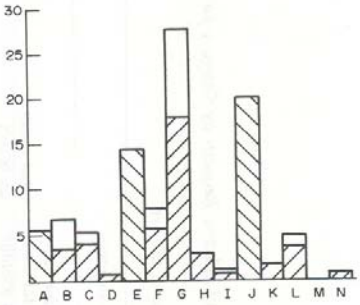
Graph 9: Teacher 3/Setting 2



Graph 10: Teacher 4/Setting 2



Graph 11: Teacher 5/Setting 2



Graph 12: Teacher 6/Setting 2

Figure 3 (continued).

Table 4

Proportion of Effective Requests by Category for Each of Six Teachers for Two Settings

Identification of teacher	T1		T2		T3		T4		T5		T6		Average rate	
Behavioral categories	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
B. Request for action	.32	.47	.42	.65	.28	.47	.50	.46	.80	.83	.35	.48	.40	.53
C. Request for child's verbal conduct	*	.71	.91	.58	.64	.50	.14	.67	.67	.87	.69	.77	.64	.67
D. Drawing attention to an object	*	*	*	*	*	*	*	*	*	*	*	*	*	*
F. Request aimed at prolonging or transforming a child's action	.53	.63	.68	.57	.49	.46	.81	.72	.81	.55	.39	.72	.61	.62
G. Request for verbalization of physical action	.58	.62	.39	.41	.50	.48	.34	.50	.54	.77	.62	.64	.48	.55
H. Drawing attention to an action	*	1	0	.93	1	.83	.67	.33	.89	.60	1	1	.77	.81
I. Request interruption of a child's physical action	.83	1	.83	1	0	.75	1	1	1	.67	.57	.50	.78	.75
K. Invitation to put the verbal conduct into practice	.25	1	.87	.86	.73	.71	.67	1	1	1	.96	1	.81	.92
L. Request aimed at prolonging or transforming verbal conduct	.50	.73	.44	.64	.65	.45	.63	.58	.62	.77	.71	.70	.61	.61
M. Drawing attention to verbal conduct	*	*	*	*	*	*	*	*	*	*	*	*	*	*
N. Seeking an interruption of verbal conduct	1	1	1	1	1	1	1	1	.80	1	1	1	.97	1
Average of effective requests	.54	.67	.57	.57	.56	.52	.56	.59	.75	.75	.59	.67	.58	.62
Total frequencies of request	104	232	212	267	307	332	135	130	95	142	191	307	1044	1410

Note. The proportion of effective behaviors was not calculated for those categories for which the behavioral frequencies were particularly low as indicated by an asterisk*.

Table 5

Frequency of Occurrence and Effectiveness Rate of Three Types of Action Requests

Identification of teacher		T1	T2	T3	T4	T5	T6	Total
Request for undetermined action	Frequency of occurrence	6	24	3	2	5	7	47
	Effectiveness rate	.83	.62	1	.50	.86	.71	.78
Request for determined action	Frequency of occurrence	10	13	9	14	2	22	70
	Effectiveness rate	.30	.76	.33	.36	1	.55	.50
Request to produce	Frequency of occurrence	14	9	17	6	4	27	77
	Effectiveness rate	.36	.33	.29	.67	.75	.29	.36

a description of the reaction of the object to the action carried out by the child. For example, a teacher can ask a child who throws a car on an inclined plane built with a rolling pin and a board: "Will it run well?" The anticipated response is of the type: "Oh yes, cars go fast" or "The cars go very far!" The teacher can also ask a child to describe the reaction of an object following an action carried out by a third person ("Did you see Serge's ball? What happened?"). In the second case, the teacher will try to turn the description not closer to the result of the action, but toward the action itself ("What did you do with that tube?"). We distinguish again between the cases in which the teacher asks the child to describe his or her own action and those in which the child must describe a schoolmate's action. In the third case, the teacher can try to have the child establish a relationship between the action carried out and the reaction of the object. We will say that the teacher seeks a statement of the relationship between the action carried out by the child and the object's reponse ("How did you do that? Tell me a bit about how that happened?"). Sometimes, the teacher invites a child to express a relationship between the action carried out by a schoolmate and the object's response.

With these requests, the teacher seeks to favor a certain conceptualization of actions. But according to Piaget (1974a, 1974b), the technique of becoming aware of or conceptualizing actions unfolds in several stages. First, one is aware of only the anticipated goal and the actual result: "The means used remain unnoticed, the awareness of them takes place beginning with observations of the object, then analysis of the results" (1974b, p. 232). But it is not enough to conceptualize the observations of the object first and then those of the action: We must also put them in perspective. As a function of this psychological analysis, we will make two hypotheses:

1. When teachers request the enunciation of a relationship between an object's action and reaction, they ask for an approach more elaborate than when they request a description of the action carried out or of the object's reaction. The effectiveness rate of the first requests, compared to that of the other types of request, will be lower.

2. When teachers request the description of an action taken, they require of the child an answer less immediate than when they request a description of the object's reaction. The effectiveness rate of the first type of request will be lower than that of the second type.

These different types of requests (description of an object's reaction, description of the action, enunciation of a relationship) can affect

Table 6

Frequency of Occurrence and Effectiveness Rate of Aimed at Prolonging or Transforming an Action

Identification of teacher		T1	T2	T3	T4	T5	T6	Total
Request for imitation of action	Frequency of occurrence	3	—	—	—	—	—	—
	Effectiveness rate	Insufficient data						
Request for continuation of action	Frequency of occurrence	8	18	10	13	16	10	75
	Effectiveness rate	.63	1	.90	1	.81	.60	.85
Request for repetition of action	Frequency of occurrence	9	8	17	9	11	20	74
	Effectiveness rate	.78	.50	.71	.56	.64	.80	.69
Request for correction of action	Frequency of occurrence	5	7	5	9	11	7	44
	Effectiveness rate	1	.29	.40	.78	.64	.28	.57
Request for amplification of action	Frequency of occurrence	8	3	17	7	9	13	57
	Effectiveness rate	.62	.33	.23	.86	.66	.77	.56

either the action taken by the child asked or by that of a schoolmate. Does this parameter lead to different effectiveness rates?

Table 7 shows the frequency of communication and the effectiveness rates of these different requests.

These results corroborate the hypotheses perfectly. Referring only to the total indexes, the following effectiveness rates were obtained: requests for description of object's reaction, .63; requests for action, .53; and requests to enunciate a relationship, .43.

Teachers rarely spoke to children about their schoolmate's actions. When they did, it was usually when the child could not conceptualize the action and they were most likely to refer to a child who had already presented the desired conduct.

Sequential Analysis of Some Teaching Requests

Our attempts at explanation can be pushed farther. We will try to explain why, of two requests of the same type made by any teacher, one gets a response and the other does not. For example, we can look at the reasons why a first request aimed at producing a result influences the child's behavior whereas a second does not.

In all interactive processes, incomprehension or episodes of incommunicability appear. Certainly, most communication models allow for "noises" or interferences which hinder the message's passage. However, there are certain communication conditions that increase the probability of success of a request. Research into these opportune conditions was carried out according to a procedure called *sequential analysis*.

This phase of the inquiry included several steps:

1. Identify, in the interactive sequence, the teaching behavior to study.
2. Determine whether or not the request is effective, that is, whether or not the expected result follows the teaching behavior.
3. Identify the kinds of events that precede the teaching behavior.

4. Study the distribution of the requests of effective and ineffective behaviors according to the different types of prior conditions, in order to identify the different types of prior conditions that distinguish effective requests.

This analysis has been applied to several of the requests which call for an elaborate cognitive process. Thus, we will examine successively:

1. Requests for determined action.
2. Requests for produced effect.
3. Requests to predict the action to take in order to produce an effect.

Requests for determined action. Within the determined action requests, five main types of interactive contexts were identified as indicated in Table 8.

Context corresponds to the following sequence: A child is carrying out an action → the teacher evaluates the action negatively or requests that he/she interrupts it or threatens the child with punishment if he/she continues → the teacher requests another action.

We can assume that an action request is more often accepted when it does not interfere with a current activity. Three types of prior conditions

Table 7

Frequency of Occurrence and Effectiveness Requests Aimed at Verbalizing Action and/or its Results

Identification of teacher		T1	T2	T3	T4	T5	T6	Total
Request for description of object's response (receptor's action)	Frequency of occurrence	18	28	68	10	17	48	186
	Effectiveness rate	.66	.50	.68	.50	.76	.68	.63
Request for description of object's response (schoolmate's action)	Frequency of occurrence	8	—	7	—	11	4	30
	Effectiveness rate	.50	—	1	—	.64	1	.67
Request for description of action taken (receptor's action)	Frequency of occurrence	50	71	116	30	22	71	360
	Effectiveness rate	.78	.41	.40	.33	.77	.70	.53
Request for description of action taken (schoolmate's action)	Frequency of occurrence	No data						
	Effectiveness rate							
Request for enunciation of relationship (receptor's action)	Frequency of occurrence	19	30	62	21	3	38	173
	Effectiveness rate	.63	.33	.39	.19	.66	.61	.43
Request for enunciation of relationship (schoolmate's action)	Frequency of occurrence	13	5	5	3	—	5	31
	Effectiveness rate	.54	.20	.60	.66	—	.60	.52

follow this principle: Context (a), insofar as the verbalization of an action is often a sign that a project has come to its end; the contexts (c) and (d), insofar as the child is not fully engaged in a project. On the other hand, in requesting a determined action when the child is already working with the material, the teacher almost inevitably interferes with the project. As to the last interactive context, it is very definitely unfavourable. In summary, we hypothesize that the effectiveness rate of determined action requests will be higher in (a), (c), and (d) conditions that in (b) and (e) conditions.

Table 8 shows the number of effective and ineffective requests as well as a statement of the effectiveness rate for each prior condition.

Our hypotheses are partially confirmed. The effectiveness rate is considerably greater than .50 (the number of effective behaviors is greater than the number of ineffective behaviors) in conditions (a) and (c), as was predicted. It is very weak in environment (e), which also was predicted. On the other hand, we notice an unexpectedly low effectiveness rate of .38 in environment (d) (the child does nothing): The child's inactivity would perhaps have to be interpreted, in some cases, as a lack of ideas and, in other cases, as a "ras le bol" toward, or loss of interest in, the activity.

In order to validate our conclusions still further, we sought to measure the degree of association of these two parameters (communication environment, variable A; result of request, variable B). For this purpose, we used Goodman and Kruskal's (1954) lambda statistic. This co-efficient allowed us to estimate to what extent the dichotomous variable B was tied to a second variable A.

> This index [of predictive association], which was developed by Goodman and Kruskal (1954), will be called λ_B,
>
> $$\lambda_B = \frac{p(\text{error} \mid A_j \text{ unknown}) - p(\text{error} \mid A_j \text{ known})}{p(\text{error} \mid A_j \text{ unknown})}.$$
>
> This index shows the proportional reduction in the *probability* of error afforded by specifying A_j. If the information about the A category does not reduce the probability of error at all, the index is zero, and one can say that there is no predictive association. On the other hand, if the index is 1.00, no error is made given the A_j classification, and there is complete predictive association. (Hays, 1963, p. 608.)

If variable B is associated or joined with variable A, knowledge of the parameter will reduce the probability of error in predicting

Table 8

Distribution of the Frequency of Effective and Ineffective Determined Action Requests as a Function of Type of Prior Conditions

Type of prior conditions	Number of effective requests	Number of ineffective requests	Effectiveness rate
(a)	15	7	.68
(b)	7	10	.41
(c)	5	2	.71
(d)	3	5	.38
(e)	1	8	.11
All conditions	31	32	

(a) The request is preceded by the verbalization of an earlier action.
(b) The request is addressed to a child who is carrying out an action.
(c) The request is preceded by preparation for the action (the child is collecting or asking for objects).
(d) The request is addressed to a child who is doing nothing.
(e) The request is preceded by disapproving comments regarding an earlier action.

category membership for variable B and will produce a conditional probability to A (p(e/A)). The lambda statistic allows us to measure this reduction in error of prediction. Conventionally, we consider the hypothesis of a functional association between the two variables to be supported if the reduction is approximately 40%.

For the data assembled in Table 8 the percentage of reduction (0.36) is close to 40%. We will retain the hypothesis of a functional association between the two variables while emphasizing the need for a clearer confirmation.

Requests aimed at producing an effect. On the subject of requests aimed at producing an effect, we have identified the same types of interactive contexts and developed the same hypotheses as we did for determined action requests.

Table 9 provides the number of effective and ineffective requests of this type as well as a statement of the effectiveness rate of each environment.

The data in Table 9 yields a value of .43 for λ_B. We can say without hesitation that the hypothesis of a functional association between the two variables can be maintained. In addition, testing the effectiveness rate allows us to note anticipated trends: Requests aimed at producing an effect affect a child's behavior most often when they are carried out in ways that do not interfere with the child's previous project ((a), (c), and (d) environments). In the opposite case, the effectiveness rate is low ((b) environment). this rate is particularly low when the result-producing request is preceded by disapproving comments.

Requests for prediction of action to be taken to produce a result. We turn now to the sequential analysis of requests for prediction of action to be taken to produce a result. In order to correctly describe in an anticipatory manner the action necessary to produce a result, the child must establish a dependent relationship. There is, therefore, a similarity between envisioned requests and requests to enunciate a relationship. However, since these requests come before the action, the interactive contexts are very different. We have identified four different prior conditions which are described in Table 10. They are as follows:

(a) The children carry out preparatory behavior and the goal they have given themselves can be seen in their behavior.

Table 9

Distribution of the Frequency of Effective and Ineffective Requests Aimed at Producing an Effect as a Function of Interactive Contents

Type of prior conditions	Number of effective requests	Number of ineffective requests	Effectiveness rate
(a)	9	2	.82
(b)	3	7	.30
(c)	4	2	.67
(d)	2	1	.67
(e)	0	2	.00
All conditions	18	14	

(a) The request is preceded by the verbalization of an earlier action.
(b) The request is addressed to a child who is carrying out an action.
(c) The request is preceded by preparation for the action (the child is collecting or asking for objects).
(d) The request is addressed to a child who is doing nothing.
(e) The request is preceded by disapproving comments regarding an earlier action.

Table 10

Distribution of Effective and Ineffective Requests to Predict Action to Take as a Function of Four Interactive Contexts

Type of interactive contexts	Number of effective requests	Number of ineffective requests	Effectiveness rate
(a) Child takes	15	3	.83
(b) Child announces his goal	8	5	.61
(c) Child accepted request	6	13	.32
(d) Child received disapproval	1	5	.17
All conditions	30	26	

(b) The children announce the result they will try to produce.

(c) The children accept a result-producing request from the teacher.

(d) The children announce the goal they aim to pursue, but the teacher reacts with a disapproving comment.

We hypothesize that:

1. Correct response to the request requires the child to establish a dependent relationship, that is, to have already carried out this action at least once. Earlier clinical observations have taught us that, more often, children set goals they can attain. Consequently, requesting a prediction of the action to take when children have set their own goals (contexts (a) and (b)) is probably propitious.

2. On the other hand, teachers generally make prediction of action requests with the objective of enriching children's experience. Requesting the children to predict the action to take in the prior condition (c) probably goes back to questioning the children on an action that they have not mastered, and so will more frequently lead to a failure of the request.

3. If a disapproving comment precedes the request, the request will most likely end in failure.

This contingency table yields a λ_B of .42. This valuation of the conditional probability of error to A allows us to confirm the hypothesis of a functional tie between the interactive contexts and the probability that a request will be successful.

More exactly, an interactive context seems particularly opportune when the child is preparing for the action. That the child has announced the goal she or he is working toward is slightly predictive of success. Finally, requests for a prediction of action to take which follows requests to produce a result are more often predictive of ineffectiveness. This is also the case with the last type of environment in which the child receives disapproval.

Conclusions

The first objective of this research was to show the insufficiency of observation which exclusively centered on teacher behavior. In connection with this research concern, the demonstration seems convincing: An important number of teacher behaviors (approximately 40%) do not produce the desired result. This statement leads us to question the relevance of establishing an interactive profile of a teacher solely on the basis of the frequency of the behaviors exhibited. Presuming a teacher's influence on the basis of a simple computation of exhibited behaviors leads to an overvaluation of his or her impact.

On the other hand, the effectiveness rate of requests varies according to the nature of the

expected response. The more the cognitive process required for responding to a request is elaborated (say by invention of a method of action or conceptualization), the weaker is the probability that the request will succeed. It is possible to increase the effectiveness rate of these requests if we make sure to address them to children under certain conditions:

1. A request addressed to a child who has just received a disapproving comment has little chance of success.
2. A request for action is particularly likely to be accepted by the child if it does not interfere with a current activity.
3. A request to predict the action to take to produce a result will be opportunely addressed to a child who prepares for the action.

In addition to the specific experimental results, this work inaugurates a research perspective. With the mediating process paradigm as theoretical background, we have come to abandon those research models in which the teaching process is conceived as a phenomenon of one-way influence, in order to adopt a resolutely interactional point of view and to specify when and how the teacher can most effectively regulate the children's cognitive strategies. Sequential analysis, which permits us to study teaching behaviors in their interactive context and to evaluate their immediate effects in terms of the functions of these contexts, provides a particularly precise methodological tool for this venture.

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