THE CONTROL OF "CLASSROOM ATTENTION": A GROUP CONTINGENCY FOR COMPLEX BEHAVIOR¹

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Cumulative time measures of classroom attention, as delineated by the teacher, were taken of four elementary classes (kindergarten, third, fifth, and sixth grades) and of 16 randomly chosen students in these same classes. Each class of students was viewed as an individual responding organism. Base rates showed considerable variability. Explicit instructions alone concerning student attention produced temporary increase for some students and for some grades. Adding group contingencies (*i.e.*, contingencies dependent on the attention of every student in the class) and token-mediated reinforcement to class achievement of a gradually increasing attention criterion raised group measures to a consistent 70 to 85% level of time attending to task as instructed, and raised individual student measures to a stable 90 to 100% level. Reversals and other data indicate that the elementary teacher can, by herself and with little effort, maximize what she considers the "paying-attention behavior" of all her students by her less-than-precise measure and consequence of the attention of the class as a whole.

"Classroom attention" has traditionally been described in terms combining psychoanalytic theory and client-centered therapy, *e.g.*, "a function of the ego strength of the individual" (Hinsie and Campbell, 1960), or a function of personality factors such as "uninhibited receptivity" (Maes, 1968). Such descriptions make the practical problems of classroom attention appear hopeless to many teachers, and educators admit that adherence to these definitions produces inconsistent results (Mostofsky, 1968). When some degree of control over attention does emerge in the classroom, "it is usually not at all clear what conditions and principles may or may not have been operative" (Harris, Wolf, and Baer, 1964, p. 9). Yet student attention, however defined, seems to be an important parameter of successful academic performance (Gilmore, 1968; Sprague and Toppe, 1965).

Perhaps the most thoroughly documented and functionally helpful explanation is that offered by Skinner (1953; 1968). In his analysis, attention is the control exerted by a discrimi-

native stimulus and most of the behaviors called attention are the result of a learning process based on the consequences that follow attending to a stimulus. Though the attention desired in a particular situation may not be strictly a form of behavior, "it does not follow that it is, therefore, outside the field of behavior. Attention is a controlling *relation*—the relation between a response and a discriminative stimulus" (Skinner, 1953, p. 123). The criterion for attention, then, is whether the stimulus is exerting any effect upon behavior.

"Classroom attention" refers to a complex and fluctuating set of stimulus-response relationships involving curriculum materials, instructions from the teacher, and some prerequisite student behaviors such as looking, listening, being quiet, *etc.* One approach to the control of these relationships is to analyze and optimize the academic stimuli, *i.e.*, the books and other media. This analysis has usually been delegated to the educational specialists in curriculum design, though there is increasing need for contributions from empirical psychology. Another approach, one particularly relevant to a psychology of human behavior, is to analyze and optimize the control itself, that is to induce the student to act selectively to special features of the environment (those responses predefined by the educational community as attending responses) by arranging contingencies of reinforcement,

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teaching him that some features of the environment are worth responding to. In this approach, "the central process is discrimination, and instruction consists simply in arranging appropriate contingencies" (Skinner, 1968, p. 122).

To this end, teachers have typically relied on verbal instructions coupled with at least the threat of aversive consequences if the instructions are not obeyed (Skinner, 1968). Another contingency is social reinforcement from the teacher for classes of attending behavior. Recent research has begun to bring to light practical limitations of this technique. For many children, adult attention and approval are not clearly reinforcing (Madsen, Becker, and Thomas, 1968; Harris *et al.*, 1964; Birnbrauer, Wolf, Kidder, and Tague, 1965; Zimmerman, Zimmerman, and Russell 1969). Even when they are, such children may still be controlled by other children in ways that interfere with the teacher's objectives (Wahler, 1967). The effectiveness of social reinforcement in controlling student study behavior also varies with the verbal and self-discipline skills of the teacher herself (Hall, Lund, and Jackson, 1968).

A single reinforcer, even the strongest and most general of them, and especially if it is selected by the experimenter, is probably unrealistic in public educational settings. To meet this problem, elaborate token economies with a variety of back-up reinforcing items and events have been devised to accelerate educational progress, and have produced significant results along many behavioral dimensions (Michael, 1967; O'Leary and Becker, 1967). Some recent studies have applied these behavioral principles and techniques in an attempt to maximize pupils' attending behavior, with significant results (Walker and Buckley, 1968; Bushell, Wrobel, and Michaelis, 1968; Zimmerman *et al.*, 1969).

However, such studies, while showing that student attention can be conditioned, have usually been concerned with the attention of students treated individually or serially. Rarely has the researcher directly focused, as the teacher must, on controlling the attention of the whole class.

As Hall *et al.*, (1968), suggested, it would seem practical and more effective to place simple direct control of the attention of the whole class in the hands of the teacher using

group contingencies. Designs that attempt to maximize classroom attention by focusing on single students or by relying on extra personnel, expensive equipment, or contingent teacher attention succeed at the expense of practicality and generality.

This study was an attempt to contribute to the objective stated by Hall by developing and examining a simple, economical, and reliable method by which a teacher can control those behaviors she considers attentive through her application of group contingencies.

GENERAL PROCEDURE

Subjects and Setting

This study was conducted in four classrooms of the elementary school in Indian Lake, a small rural-village community in southwestern Michigan. For 2 yr the school had been the scene of a gradually developing experimental program in behavior modification. Several of the teachers, including the third- and sixth-grade teachers in this study, had received college credit for an introductory extension class in classroom management, and at the time of this study most of the classes were on some form of token economy (Ulrich, Wolfe, and Bluhm, 1968).

Kindergarten. The kindergarten class of 32 children met 2.5 hr daily. The experiment was conducted during the introduction-to-reading period. Typically, the teacher would present a new language sound printed on large cards. For about 10 min she would lead the children in sounding it out, pronouncing words with that sound in it, and identifying its position in the word. Then she would give each child a worksheet that required the child either to identify a word and draw its picture or *vice versa*. The total reading period lasted about 30 min each day. Also included in their half-day schedule were a numbers period, milk-and-crackers, gym or playground, and library or records or story time.

Third grade. The third grade had 34 children who collectively had gained a reputation as the scourge of the school district since entering kindergarten. Many anecdotal explanations for this were popular, including the "wave theory" of periodic hyperactive classes. A reading-group period, held three days a week for about 30 min each day, was chosen for this experiment. The teacher met in a

front corner of the room with the same eight students and led them in reading, spelling, and discussion of meanings of words and interesting points in the story. During this period, the other 26 students were expected to engage in independent work, as listed for them on the board, such as spelling exercises, math problems, and study-guide questions for a reading assignment. If all the assigned tasks had been completed, the student was expected to read for the remainder of the time. Students rarely, if ever, completed the list in a given day.

Fifth grade. The fifth grade of 25 children was studied during its 50-min reading period three days a week. The procedure for this period was changed midway through the experiment. During baselines and the first two days of Instructions Only, the teacher led one-half of the class in reading and discussion of the text and its meaning. The other half was given instructions, written on the board and summarized verbally at the beginning of the period, for independent work in reading, writing reports, or drawing illustrations of stories they had read. The teacher alternated her involvement from day to day between the two groups. For the remaining 27 sessions, all students were expected each day to do private reading, write short reports on each book or story, or prepare a worksheet given to individual students by the teacher. During this time the teacher would hold 5- to 10-min conferences at her desk with individual students, meeting with each student once a week. Here, the student would describe what he had read the past week, and would turn in and discuss his reading reports and any worksheets he had been given. The order of conferences was listed daily on the board, as were the instructions for independent reading.

Sixth grade. The sixth grade of 30 students was studied during its 50-min social studies period three days a week. The procedure in this class was less uniformly structured. Typically, it included about 25 min of teacher-led discussion and common reading from their text, about 20 min of private study and writing answers to questions from the same text, and frequently a short closed-book quiz. Occasionally, 5 to 10 min would be used for special student reports. On two occasions a movie was shown for most of the period and no data were taken.

Recording

The observations and recording were carried out simultaneously by the teacher and the experimenter. The teacher used a stopwatch (during Baseline₁) or a timer-light device. A Cramer 1/100-sec timer, housed in a 3 in. by 5 in. (7.5 by 12.5 cm) metal box, with a silent, single-throw mercury switch, was on the teacher's desk; a red light (40 w) on a flat 3 in. by 3 in. (7.5 by 7.5 cm) wooden stand was placed either on the teacher's desk or on a portable stand, but always positioned to be prominent to the students. The timer was connected to a wall socket, and the light to the timer. When the switch was flipped up, the timer began running and the light went out; when the switch was flipped down, the timer stopped (without resetting) and the light went on. The experimenter sat to the side, near the front of the room, with a panel of four Cramer 1/100-sec timers, each operated by a silent, single-throw mercury switch. Within each of the four classes observed, sometimes the experimenter was able to see the teacher's light; usually he was not. This variability, even within the same grade, was due to periodic changes in student-elected seating arrangements.

The dependent variable was a complex set of behaviors. The "attention" that the teacher desires of her students refers to a high degree of control by a complex set of stimuli (verbal, written, the teacher, *etc.*) which she has identified as important to the student's education. To treat each of these stimulus-response relations separately or to adopt instrumental measurement techniques would add precision to the control but would subtract generality from its applicability to the classroom.

In this study, student attention was defined broadly and operationally in three classes of responses: (1) bodily position appropriate to and directed toward the designated academic stimuli, as indicated by the teacher's rules for the class (*e.g.*, fully seated in the designated chair, facing the desk, eyes on the book or teacher or blackboard); (2) appropriate silence (*i.e.*, vocally and physically quiet); and (3) responding appropriately to instructions as given by the teacher to the students during the class period (*e.g.*, "Leave your pencils on your desks"; "Open your readers to page . . .", *etc.*).

It is clear that the first two of these classes of "attention" responses do no more than infer a controlling relationship; they were included here because they are traditionally considered prerequisites to a third broad class that allows the teacher to define specific "attention" responses on the spot and more clearly involves a controlling relationship leading to a measurable educational product.

Inattentive behaviors included the following: head or eyes turned away from the book, paper, board, or teacher as per instructions; out of seat without permission; talking to a neighboring student or to oneself to an extent that was audible to the teacher or the experimenter; kicking the desk or chair; scraping feet; dropping objects; doing written work when discussion was called for; doing other unauthorized academic work. Class attention was defined as the above attention exhibited concurrently by all students.

The teacher engaged the timer only when in her observation every student was attending; if one or more students were inattentive by the above definition, she disengaged the timer and turned on the light. Except for this, she proceeded as usual with her teaching, supervising, and commenting.

The experimenter, however, rated the cumulative attending time of only four students, randomly chosen, whose identity remained unknown to the teacher. The same four students were rated during each session of the experiment for each grade.

The cumulative attention times were tallied from the five timers at the conclusion of each session, and the five corresponding percentages were calculated by dividing each timer reading by the total time for the session.

Reliability Checks

Two investigations of reliability were carried out. In one, reliability checks on the experimenter's measures were taken during all phases of the experiment. Undergraduate students in psychology or education were given a brief description of the study, the teachers' list of attentive and inattentive behaviors, and several practice sessions; they were not told what phase the experiment was currently in. The observer chose one or more of the four students being measured by the experimenter and measured attention in the same manner as the experimenter was measuring the attention of

four students. Both the observer and the experimenter recorded the cumulative timer readings for this student (or students) at the end of each consecutive 2-min interval (as signalled by the observer) during the session. Six such reliability sessions were recorded, one for each phase of the experiment. Table 1 lists the results, in percentages of attention time, for the 2-min intervals for each phase and each grade. In general, the 77 correlational checks on the attention measures of the individual elementary students yielded a product moment correlation coefficient of 0.967.

In addition, an attempt was made to evaluate the teacher's measure of the attention of the class as a whole. The most direct method would have been to have an observer measure the class as a whole in the same way the teacher measured, but since the teacher's role in this study was to carry on her normal teaching activities while also recording the attending behaviors of the class as a whole, it was presumed that her observation would be intermittent and imprecise. Therefore, no direct check was made on the degree of that imprecision. But of basic concern to this study is the degree to which, given the teaching activities currently valued in public education, the individual teacher can observe and measure the attention of the class as a whole with enough accuracy to be the basis for applying contingencies with significant control over all her students. The degree of control was deemed to be of more critical importance than the degree of accuracy.

In this study, the experimenter's exclusive concern with the attention of four students was designed not only to investigate the effects of the teacher's measurement and consequent on the attending behavior of a random sample of the population, but also the possible correlations between individual and class changes in attention from phase to phase. To this end, a second reliability analysis was computed for each class by first computing the mean per cent attention rate of each of the four students for each phase considered as a whole, then averaging these four means for this same entire phase, computing a similar mean of the teacher's rating for each phase of the study, and finally comparing the consecutive interphase variation of these two sets of means. Table 2 presents the results of this analysis. In general, the mean product mo-

Table 1

Reliability Checks by an Outside Observer (O) on the Measures of the Experimenter (E)

B_1 Kindergarten		B_2 Third Grade		IO_1 Fifth Grade		R_1 Third Grade		IO_2 Sixth Grade		R_2 Fifth Grade	
E	O	E	O	E	O	E	O	E	O	E	O
70	80	15	30	54	62	93	100	86	89	75	82
50	67	50	62	70	75	55	52	83	73	100	93
50	50	57	45	27	31	42	45	80	71	82	85
50	65	52	66	85	95	100	100	75	78	25	22
4	3	70	75	80	85	72	75	52	61	95	94
90	85	50	52	72	72	100	92	30	33	93	95
2	2	3	1	95	95	52	50	42	45	40	40
		75	72	85	87	50	62	100	99	85	87
		50	53	100	100	87	81	100	100	98	98
		65	70	85	87			99	96	82	87
		30	33	100	100			89	95	100	100
				92	100			10	12	82	83
				100	100			40	40	100	99
				100	100			91	84	100	100
				87	87			75	76	99	98
				100	100			93	95	85	80
				74	80					87	87
r_{xy} : 0.97		0.93		0.98		0.96		0.98		0.98	

ment correlation coefficient for all four grades was found to be 0.955.

EXPERIMENTAL CONDITIONS

Baseline₁ (B_1). The teacher unobtrusively used a stopwatch to measure attention of the class as a whole, as described above. The experimenter measured the attention of four students. No announcement or explanation of this procedure was given to the students. The teacher was instructed to react to the behavior and performance of her students under the same norms (including manner and frequency) as those on which she had relied before the study began.

Baseline₂ (B_2). The teacher now began using the timer-light device to measure attention of the class. There were no contingencies or instructions and any questions regarding the light were answered with: "We will tell you about it later." This phase was introduced to study and, if necessary, to stabilize any novelty effects of the apparatus on attention.

Instructions Only₁ (IO_1). At the beginning of this phase, the teacher told the class that she would like to explain to them why the light was going on and off during class. She then stated the kinds of attention she wanted from them (position of body and eyes, no inappropriate noise, following instructions),

wrote them on the board, and gave several examples of inattention in each category. She then explained that when one or more students were inattentive in any one of these ways, she would turn the light on, and when all students were paying attention she would turn the light off. The exact phrasing of these instructions varied somewhat, especially to the kindergarten and third-grade students. But in all cases the instructions lasted from 4 to 6 min and were briefly (30 to 60 sec) summarized at the beginning of each subsequent session of this phase.

Reinforcement₁ (R_1). Reinforcement for attention in the kindergarten class consisted of access to a play activity (recess, gym, or a group game in the room); for the third-, fifth-, and sixth-grade, points or tokens were given that could be exchanged at specific times for various privileges (e.g., use of a private study booth, sitting next to a friend, use of a class typewriter, being a "Teaching Assistant") and activities (time in the gym or in the Fun Room with its games, paint, electromechanical equipment, piano, etc., or in the library). The list of purchasable privileges and activities varied from grade to grade; the students made up their own list of desirables and the prices they thought appropriate.

In the R_1 phase of this study, the contingencies were first explained to the students by

Table 2
Comparison of Individual and Class Scores

		Phases														
Grade	Subject	B ₁		B ₂		IO ₁		R ₁		IO ₂		R ₂		R ₃		PPM
		MA	MMA	MA	MMA	MA	MMA	MA	MMA	MA	MMA	MA	MMA	MA	MMA	
6	A	66		76		69		95		76		96				
	B	41		44		50		88		74		93				
	C	64		68		52		95		79		95				
	D	60		68		52		95		79		95				
	Class	18	18	23	23	24	24	78	78	43	43	76	76			
	A, B, C, D		58		64		58		93		79		95			0.98
5	A	83		81		80		94		80		96				
	B	76		78		85		96		86		95				
	C	81		79		83		96		88		96				
	D	67		69		70		88		72		93				
	Class	26	26	30	30	58	58	78	78	58	58	80	80			
	A, B, C, D		77		77		80		94		82		95			0.91
3	A	46		60		59		80				89				
	B	27		34		28		75				83				
	C	38				67		81				89				
	D	50		31		43		79				90				
	Class	0	0	1	1	1	1	24	24			50	50			
	A, B, C, D		40		42		49		79				88			0.95
Kind.	A	47		55		52		83						91		
	B	63		64		66		92						91		
	C	43				65		92						95		
	D	56		54		65		87						89		
	Class	9	9	8	8	13	13	60	60					58	58	
	A, B, C, D		52		58		62		89					91		0.98
Mean PPM: .955																

Legend—MA: Mean per cent attention time per phase
MMA: Mean of MA
PPM: Pearson product moment correlation computed by phase for the two MMA scores

their teacher. She briefly reviewed the behavioral specifications just as she had the day before and then explained that three points per student (in the fifth and sixth grades) or three tokens (temporarily in the third grade, before they too began to use points) or play activity (in the kindergarten) would be contingent on the class as a whole reaching a specified criterion. This criterion also varied from class to class, since it was established at a slightly higher value than the performance that each class had previously demonstrated during the baselines and Instructions Only phases. A bonus of two extra points or tokens (or, for the kindergarten, 5 min extra of activity) was contingent on the class exceeding the criterion by 5% or more. These two criterion numbers for normative and bonus performance were written on the board at the beginning of each reinforcement session. At the end of each session,

after a quick calculation, the teacher's rating of class attention for that session, expressed as a percentage of total, was written on the board under the criterion numbers, and the teacher briefly verbalized the comparison and the consequences (*e.g.*, "Your attention as a class today reached 60%; this is 2% short of our goal, so nobody gets any extra points today."). When the class achieved criterion for three sessions, that criterion was raised by 5% for the next session; if in any given session the criterion was exceeded by 5% or more, criterion for the next session was raised by the amount of that excess to the nearest 5% (in addition to the awarding of bonus points). The meaning of these numbers as percentages of class attention was briefly explained to the fifth and sixth graders, who had already dealt with percentages in their mathematics classes; to the third grade and kindergarten

classes, the numbers were simply presented as target numbers. With no class was there any attempt to determine the degree to which the students grasped the mathematical or behavioral significance of the numbers or the explanations, except by measuring the change in their attending behavior.

When criterion was reached on a given day, the teacher announced that she would give each student three points. In no class were the points or tokens given out immediately; the teacher's normal pattern was to dispense points (or tokens) in the students' pointbooks after school (in conjunction with her evaluation of some assignment sheets) and/or at one or two other specified times during the day. In reinforcing attention, the individual teachers followed their normal dispensing procedures. For the kindergarten class the reinforcing activity, when earned, usually followed the experimental session immediately, though on several occasions it was delayed for about half an hour because of scheduling difficulties.

Instructions Only₂ (IO₂). A reversal to the previous IO₁ conditions was carried out in the fifth and sixth grades. The teacher, as before, reminded the students of what the light meant on and off. She then added, without elaboration, that she would not be giving out points any more for this behavior, but that she still expected the same amount of attention.

A different and unplanned reversal occurred in the third grade. Five months before this study began, the third-grade teacher had imposed an all-or-nothing contingency on her class: if she discovered any instance of token theft, she would cancel all aspects of the token economy for all students. Subsequently, individual students would on occasion complain that their tokens had been stolen, and the teacher would always suggest that the student search his desk and notebooks thoroughly and then report back; inevitably the missing tokens were found—until after the twentieth session of this study. As a result, the token economy and the sessions on attention were discontinued for three weeks. Then, a point system and a somewhat modified list of purchasable reinforcers was introduced, along with the reinforcement phase of the attention study preceded by a one-day baseline measure of attention (Session 22).

Reinforcement₂ (R₂) and *Reinforcement₃* (R₃). The same procedures and conditions as

in R₁ were applied for the fifth and sixth grades in this phase (and for the third grade when their point system was introduced), except that a lower-limit response-cost contingency was also introduced. If the class failed by more than 5% to meet normative criterion, the teacher deducted three points from their pointbooks.

Reinforcement₃, carried out only in the kindergarten, involved the same procedures as R₂ but the academic setting changed considerably. At this time the teacher judged that the children were ready to begin small reading groups. From Session 26 on, the teacher worked with six to eight students in one corner of the room while the other 25 or so were instructed (for the first time in their school experience) to engage themselves for about 30 min in independent work (worksheets, picture-word books, coloring) without the advantage of the fairly constant teacher-class interaction to which they were accustomed. Attention was defined in terms of bodily position, appropriate silence, and following the teacher's instructions that specified the independent work in which the students were to engage themselves.

RESULTS

Figures 1 through 8 graph the results of the experiments. Table 2 presents averaged results from each grade. Several features appear to be common to all four sets of data.

The figures show, and Table 2 confirms, the high correlation between class attention (as measured by the teacher) and individual student attention, thus indicating that the teacher's measure, however imprecise, can be used reliably to control individual day-to-day student attention.

The attention of an individual child during baselines often varied greatly both in relation to his own past performance and in relation to another child's current performance (e.g., Fig. 3, B₁). The attention of the class as a whole also showed consistency in its inconsistency, both during baselines and IO₁ (e.g., Fig. 5).

The timer-light device, when introduced without explanation (B₂), appeared to have no clear effect on attention in either direction, except possibly in the sixth grade (Fig. 5) for one session.

Fig. 1. Sixth-grade students and class.

Fig. 2. Fifth-grade students and class.

Fig. 3. Third-grade students and class.

Fig. 4. Kindergarten students and class.

Fig. 5. Sixth-grade class.

Fig. 6. Fifth-grade class.

Fig. 7. Third-grade class.

Instructions with associated stimulus (red light) but without explicit consequences (IO_1) had mixed effects on attention. In two classes (Figs. 7 and 8) there was only marginal improvement, if any, in class attention, though several individual students (Fig. 3, A and C; Fig. 4, B and D) seemed at least temporarily to improve. In the other two classes (Figs. 5 and 6), the effect of these instructions and stimuli was immediate and significant for most students, but the improvement rather quickly decreased toward baseline performance.

Invoking graduating group reinforcement contingencies for attention to academic work with feedback from the red light (R_1) not only dramatically increased and maintained the attention of the individual students at a high percentage, but also reduced their variability significantly, if not immediately (as in Fig. 2, R_1 , A, B, and C), then at least after five or six sessions (*e.g.*, Figs. 3 and 4, R_1). The same effect is seen in the measure of attention for the class as a whole; bi-directional variability is replaced by variability in the positive direction.

The degree of increase in per cent attention time appears to be fairly constant between classes and for all individual children. All individuals measured eventually reached an apparently stable level of 90 to 100%. The class as a whole leveled off, in two cases at about 70% (Fig. 7, R_2 ; Fig. 8, R_3) and in two cases at about 80% (Figs. 5 and 6, R_1 and R_2).

Reversals (Figs. 1 and 2, IO_2) resulted in class and individual attention times gradually approaching performances hardly distinguishable from baselines and IO_1 , except possibly by the day-to-day variability; given a few more reversal sessions that too might have reappeared clearly.

Connecting the red light again with explicit reinforcement and graduating criteria (R_2) re-established within five sessions a 90 to 100% level for individual students and an 80% average for the class as a whole.

In the kindergarten reading-group phase (Fig. 4, R_3) the more demanding attention requirements resulted in the class attention level dropping 30 percentage points for four unreinforced sessions, but rising quickly again to a

Fig. 8. Kindergarten class.

steady level of 65 to 70%. A proportionate drop and recovery was seen also in the attention of the four individual students measured (Fig. 8, R_3).

DISCUSSION

The high baseline variability in the attention of individual students and of the class as a whole might be described by the teacher as a "good days, bad days, high and low days" phenomenon. Behaviorally it is clear that in a classroom situation, even where serious attempts have been made to begin to control student behavior carefully, there is a wealth of interesting variables interacting and competing for the attention of the students. Many are not clearly related to the objectives of education (Martin and Powers, 1967).

The finding of a variable effect of instructions (*i.e.*, little, if any, in kindergarten and third grade, and significant but short-lived in fifth and sixth grades) is not completely in agreement with the report of "no appreciable effect" by Madsen *et al.* (1968), and would seem to invite further research. The reason for

the variable effect of instructions in the present experiment is not clear. It may have been a function of the individual teacher's "personality and approach" or of the amount of student experience with academic contingencies, since the two grades that responded temporarily to instructions were relatively older than the two that did not. It may simply have been a reflection of recent past and current environmental contingencies, since the two grades that did not respond to instructions were the grades with very low baseline levels of class attention. When students are not attending to school work, they are usually attending to other non-academic stimuli, presumably because the reinforcers are stronger for these behaviors, strong enough to override the added contingencies involved in verbal discriminative stimuli for academic attention. In any case, the present data seem to argue strongly against relying on instructions from the teacher for the maintenance of classroom attention.

But coupling instruction with group contingencies produced significant, stable, and feasible maximization of classroom attention. This

confirms and extends similar results with students treated individually (Bushell *et al.*, 1968; Walker *et al.*, 1968) and with different dependent variables (Schmidt and Ulrich, 1969) and is, of course, in complete agreement with Skinner's analysis of classroom behavior (1968). It also suggests that the traditional educational emphasis placed on making the curriculum stimuli "attractive" (color, format, media, *etc.*) is an inducement that may actually make the student "less likely to pay attention to things which are not on their face interesting" (Skinner, 1968, p. 121). Emphasis might be more effectively placed on the stimuli that follow appropriate academic responding.

Interestingly, the related "change-of-task" facet so typical of many class routines never became an attention problem in the present study, except briefly for the kindergarten as described above. The sixth-grade social studies class, for example, involved a variety of curriculum materials and tasks every session; the fifth grade, midway through the experiment, completely changed its reading period procedure. But when somewhat different behaviors were required, the teacher simply stated the new instructions once, after which the light and the consequences seemed to be able to correct any new attention problems.

Teacher reaction to the study proved interesting. Two of the teachers agreed rather eagerly to participate in the study. The other two were reluctant at first; they were not impressed with its potential usefulness ("hog-wash", as one rural teacher described it), and they were hesitant about the demands it would make on their class time. They finally agreed to begin the study only on the condition that they would be free to discontinue it whenever they felt it had become inconvenient. ("I'll give it a try for a few days, but I'm telling you my heart's not in it.") As the graphs indicate, all the teachers who began the study completed it, even putting up with reversal. They continued the procedure and their own daily measuring after the experimenter finished taking his data, reporting a steady or rising class attention level. In addition, other teachers in the school began using the same procedure and equipment for other classes and study halls and reported they were very pleased with the results.

It is clear from this study and others that success in motivating all the students in a

given class to a particular behavior such as consistent attention is largely dependent on a reinforcement system that is sufficiently general to appeal to all students, such as a type of token economy with many backup reinforcers determined by the children themselves. If this is not the case, then the effectiveness of the attention stimulus procedure described here would be proportionately diminished. On the other hand, an impressive array of reinforcers may not be sufficient to motivate a high rate of academic progress and the necessary precurrent behaviors, especially if these precurrent behaviors, such as consistent attention, are not already strongly developed and maintained.

The results do not indicate whether the light, automatically connected inversely with the teacher's timer, functioned as a discriminative stimulus, a conditioned reinforcer, a conditioned punisher, or as all three. Following the suggestions of Terrace (1966), two contrasting stimuli (light off, light on) were used in this study, the one correlated with reinforcement and the other with non-reinforcement. By using a built-in training method, the target S+S- difference was progressively approached from a larger S+S- difference. After the students were exposed to the program, the red light may have acted also as a conditioned reinforcer and punisher. When a student who had been paying attention to the teacher or to his book for some time noticed that the light was off, his attention was probably reinforced at that time for maintaining similar behavior for the next few minutes. Similarly when a student, prompted by the red light going on, ceased a specific inattentive behavior and immediately noticed the light go off, he was probably reinforced for this desirable change. But the procedure may also have involved punishment, *i.e.*, suppression of inattentive behavior, as when a student began to be inattentive or had been so for some time and then noticed the light turned on or already on. The nature and interaction of these various effects would be very difficult to analyze precisely, since the two sets of behaviors are themselves so diffuse. It is not clear that such precision would significantly improve the effectiveness of this procedure.

In any case, the light provided constant intrasession feedback to the students. The precise extent and durability of its effect were not

analyzed systematically; subjectively, the teachers and several observers were impressed with (and often amused by) its power. At the very least, the red light allowed the students to discriminate very expertly between when they could get away with extra-curricular attention and when they could not. Presumably the use of the light also lessened the danger of a student being inattentive in order to get some reinforcing attention from the teacher. With the light the teacher could (and did) avoid verbal reprimand and other stereotyped dramatics associated with such problems. It is probably safe to assume that not too many of these rural elementary children had a history of being reinforced by attention in the presence of a red light, and whatever moral issues are involved in beginning such a history in children will have to be weighed against its other advantages.

More feedback of this type would ideally be desirable and helpful, for example by means of a large percentage clock or a cumulative time-thermometer joined to the teacher's timer and prominently displayed to indicate minute-by-minute progress toward criterion for a given period. Such added devices were rejected in this study on the grounds that their expense would make the results of this study less generally applicable to the typical classroom.

Another control factor implied but not directly analyzed in this study is that of peer control. Students can function in competition with the teacher and materials as a stimulus for the attention of others, and interaction with other students is a strong reinforcer for many (Brackbill and Jack, 1958; Wahler, 1967). When this is true, a program of reinforcing attention would be proportionately enhanced by making peer approval or disapproval contingent on a student's attention to task, and a behavioral analysis of peer control would be of great value to education. Subjective observation and other anecdotal evidence from all four classes in this study indicated considerable peer interaction of this type. Though such pressure never reached the "back-alley trouncing" stage, there were frequent instances, both during and after classes, of students not hesitating to remind or even scold a classmate for "keeping the light on", and to congratulate an improved student. And of course exceeding the criterion, especially by 5%, was always cause for common student

celebration, an outburst that the teachers did not seem to mind at all.

Although the critical features of this procedure seem to have been the specific group reinforcement contingencies coupled with the intrasession feedback from the light, several other explanations of the results should be considered in summary. These results cannot be accounted for by the novelty effects of the apparatus, since its introduction without contingencies had no noticeable effect (B_2), even though stimuli were correlated with attentive and inattentive behaviors just as they would be later in reinforcement phases. Specific instructions from the teacher, repeated daily and coupled at the end of each session with verbal and social stimuli, such as praise for improvement or admonitions to do better, led to temporary improvement at best. Peer pressure may have accounted for some of the improvement, but since this factor seemed to have its effect only during reinforcement phases, its own power is probably best explained by reference to the reinforcement contingencies themselves. Differences among subjects (and probably their teachers), very apparent in the base rates, were mostly eliminated after several sessions under reinforcement. The effect of simple passage of time is eliminated as a significant factor by reference to the reversal stages. Variations in the tasks defined as attentive for each grade cannot account for marked increases in attention because the improvement was similar for all grades despite this diversity. Even when, as in the kindergarten, the task was suddenly made different and more difficult, the decline in rate of improvement was only as temporary as the increase in rate with the introduction of specific instructions. The subsequent increase in attention showed every sign of being as high and stable as for other tasks and other grades. And finally, since the measures of attention were not fully and automatically mechanized, there is the possibility that human bias or error accounted for the changed attention levels. Such an explanation is shown to be improbable, not only by the correlation checks made on the experimenter's measures (Table 1), but also by the high degree of correlation, phase by phase and for every grade, between the experimenter's measures of four individual attention levels and the teacher's measure of the attention of the class as a whole (Table 2).

Taken all together, the results indicate that this procedure is an inexpensive and easily manageable one whereby the teacher can maximize the attention of each student, though she relies only on her less-than-precise measurement of the behavior and presentation of the consequences to the class as a whole. Though this study made no attempt to evaluate the long-range effects of student attention thus maximized on academic progress as traditionally measured, the implications of such a procedure for general education today, at least at the elementary level, are potentially impressive. Educators and behavioral psychologists agree that many aspects of content, organization, and scheduling in current elementary education could be greatly improved. But they also agree that despite these defects the methods and content of public elementary education are effective for many students. It has also been shown that the instances of ineffectiveness, *i.e.*, chronic low achievement in many students, are highly and invariably correlated with patterns of inattention in school. One approach to the problem is to search for the causes of this inattention, which (if we ever could complete the list) might be multiple, varied, and vague. The cure for these causes may be equally unmanageable. Another approach is to attempt to eliminate the inattentive behavior, whatever its causes in the individual child.

Underlying these divergent approaches is the fundamental question: "Why isolate student attending behavior at all?" It is argued that attending behavior is a self-management skill, precurent to the goals of education; the most direct and efficient design for education is one that isolates the various terminal behaviors which, taken as a whole, we call knowledge. Thus, the development of appropriate knowledge behaviors would be programmed by use of successive approximation, small and realistic steps, and systematically applied reinforcement to maintain and maximize rate. In such a system, attention would take care of itself, because the predefined objects of attention would in themselves be adequate stimuli for the response of maximum attention.

While the radical idealism and apparent parsimony of this approach are appealing, it is inadequate for two reasons. First, the day when a thorough and scientifically sound educational environment is commonplace in our

public education may be fast approaching; at least let us hope so. But that day is clearly still to come. Many such systems, with varying degrees of control, are currently being developed in experimental settings and in a few "normal" settings. But the psychologist interested in educational applications is typically stalled not only by the incompleteness of his own technology and his science, but also by arguments about tradition, finances, individuality, creativity, and naiveté. Such arguments may not always be valid or relevant, but they are usually the variables in control of innovation.

Also, and perhaps of more lasting significance, where such a program can be implemented, it may still be insufficient for many students. As Skinner (1968) argued, attending is one of several behaviors traditionally identified with thinking, but technically precurent to it, which must be analyzed and taught as such. In education we are concerned with two behaviors: attention to a stimulus, and a response to it. Normally, reinforcing the second stage strengthens the first.

"We set tasks which demand attention and reinforce the student when he is successful or punish him when he is not, presumably because he has or has not paid attention. He is left to discover how to pay attention for himself. The method often works. . . . But a better technique is to teach the precurent behavior directly. . . . Much of the elaborate art of looking and listening cannot be taught simply by reinforcing the student when he responds in ways which show that he has previously looked and listened carefully. Direct instruction is needed (pp. 122-123)."

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