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Relationship of Weather Phenomena and Disruptive Behavior in Special Education Classrooms

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RELATIONSHIP OF WEATHER PHENOMENA AND DISRUPTIVE BEHAVIOR IN SPECIAL EDUCATION CLASSROOMS

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CHAPTER I

INTRODUCTION

The effect that the weather has upon behavior is implied in common expressions such as "sunny disposition," "stormy emotions," "face as dark as a thundercloud," and "tempestuous feelings" (Mills, 1958). Lokke (1962) suggested that the activity of animals immersed in air is influenced by the properties of that medium. Numerous studies have investigated this contention by attempting to relate certain behaviors to weather phenomena.

The effect of heat upon performance was investigated by Mills (1950, 1953), who suggested that difficulty in dissipating waste heat is followed by a decline in physical and mental activity. He found that college students achieved ratings only 60 percent as high in the summer heat as in the winter cold on standard aptitude and intelligence tests administered at Cincinnati latitudes across the country. He found no such seasonal contrast in rating the northern tier of states, in which summer and winter temperatures are more similar. Mueser (1953), however, found no apparent effect of temperature upon arrival time of employees of an engineering research laboratory. Huntington, Williams, and Falkenburg (1933) cited evidence that the cadets at West Point and

Annapolis obtained the best grades when the outdoor temperature, averaged between night and day, was about 40^{o}F. Evidence was also found by Bradley (1951) that people are most active mentally when the air is moist and the temperature averages about 40^{o}F. No support for a mental optimum at temperatures between 40^{o} and 50^{o}F. was found, however, when the reading of serious books was considered to be a gauge (Huntington, 1945). Studies done by Huntington (1926) showed that people in factories from Connecticut to Pittsburgh and in Florida worked best when the outside temperature averaged from about 60^{o} to 66^{o}F. Cuban cigar-makers at Tampa, Florida, were shown to do poorer work when the temperature fell below 65^{o}F. However, Markham (1947) concluded that men work hardest and most efficiently when indoor temperatures are between 60^{o}F. and 76^{o}F. and when relative humidities are between 40 and 70 percent. Huntington noted that a rise in temperature was generally, although not always, accompanied by poor work.

A suggestion was made by Huntington (1945) that disinclination to work disappeared after rain began to fall, and Mueser (1953) failed to find a difference in the arrival time of employees between precipitation days and days of fair weather. Huntington (1945) stated that storms served as a stimulant to activity and cited as an example the instance in which the freshmen at Massachusetts State College in Amherst took a test prepared by the American Council of Education during a hurricane. Ordinarily the college ranks at the 75th percentile among colleges taking the test, but that year it rose to the 95th percentile. On the day before the hurricane, the freshmen had ranked 4 percent above the average of sixteen preceding classes on the Army Alpha test. Two days after the hurricane, the students took another test on which they averaged 10 percent lower than the two preceding classes which had taken the identical test.

A study by Webb and Harlow (1964) involving naval aviation cadets indicated that changes in barometric pressure away from the prevailing pressure are associated with sleep tendencies, as indicated by electroencephalograms. Barometric tendencies, however, were not shown to be significantly correlated with employee punctuality (Mueser, 1953). Furthermore, Gibson and Stuart (1942) found no relationship between atmospheric pressure and extrasensory perception. However, Mills (1958) suggested that barometric pressure had a definite effect upon behavior and moods. He maintained that farm animals were restless and irritable during the advent of low pressure storms. He also suggested that frustration, despondency, irritation, suicide attempts, and fainting spells were more common under conditions of low barometric pressure. He proposed that body tissues take up additional water when a "low" is approaching and pressures are falling. Mills suggested that as an individual drinks fluids to refill his intestinal tract, swelling of the vascular system increases the pressure on the brain, hindering clear thinking and impairing orientation to surroundings. On the other hand, Mills believed that individuals were more persuasive in making a point and more intelligently receptive to the ideas of others during times of rising pressure (1958).

Reactions due to the meteorologic environment were found in both the normal individual and the psychotic patient by Reese (1942). The passage of a warm air mass was found to be associated with onset of hypomania in the manic-depressive. It was suggested that a period of acute anoxia coinciding with vascular spasm was responsible for precipitating the change in mood. On the other hand, passage of a cold air mass was associated with vasoconstriction and increased blood pressure, followed by a relative acidity, lowered blood pressure, and increase in the basal metabolism rate.

The influence of weather upon incidence of maladaptive behavior has been examined by Petersen and Reese (1940) who were of the opinion that weather conditions are highly significant because they are relatively prolonged and inescapable. They expressed a view that hereditary dispositions and constitutional tendencies in the general psychopathic population are precipitated by weather conditions. A study by Hyman and Wohl (1958) indicated that the number of individuals presenting themselves to the Detroit Veterans' Administration Mental Hygiene Clinic was not significantly related to the presence of rain, snow, and/or sunshine for the year 1956. In investigating seasonal admission rates to a state hospital, Hauck and Armstrong (1959) concluded that sociological, economic, and cultural factors had greater relevance than weather *per se*.

The relationship of suicides and weather phenomena was investigated by Blumer (1945). He found that 54 percent of the cases occurred with south wind conditions, and 32 percent of the cases occurred with passage of cold or warm fronts. In 70 percent of the total number of cases, a weather disturbance was established. The highest number of suicides were found during spring and summer with the lowest in autumn. Stable, high pressure weather was associated with the least number of suicides. Dexter (1904) found that most suicides and sex crimes occur in June. He also found a relationship between the temperature and incidence of assault and battery cases. Huntington (1945) noted that sexual "extravagance" and prostitution seem to reach a maximum in the hottest, dryest parts of the world. Hellpach (1911) reported that sexual irregularities in Italy increase greatly during the sirocco, a dusty, northward wind that brings hot, dry weather. Hellpach noted that offenses committed during the time in which the sirocco is blowing are condoned to a degree.

Teachers have suspected that weather conditions influence the classroom behavior of their pupils, as reflected in the common belief in some areas that more behavior problems are to be expected on windy days than on days when the wind doesn't blow. A teacher in a novel by Patton (1954) attributed the restlessness of her students to the warm weather.

In a comprehensive examination of weather phenomena and behavior in New York and Denver, Colorado, Dexter (1899) tabulated the answers of teachers in both areas regarding pupil deportment. Generally, he found that cold, calm days were depicted by the teachers as being favorable to good behavior and that muggy, hot days were reported as being unfavorable. Windy days, stormy days, and cloudy days were not seen to have much influence.

Dexter (1899) also studied the reported behaviors of school children and certain groups of adults during the occurrence of various weather phenomena. On cloudy days, the deportment of both the Denver and New York school children was better than during any other weather phenomenon. It is notable that the teachers interviewed in Dexter's study did not perceive cloudy days as having much influence. Fewer disturbances were reported on days when precipitation occurred than when it did not; a suggestion was made by Dexter that rainy days sapped the children's vitality. For groups of adults, disturbances were greater than expectancy when the temperature was above 45° and below 65° F.; children, however, showed no fixed pattern. Dexter also found that low humidity was associated with disorder; when humidity was less than 30 percent, Denver school children were punished four times more frequently than expectation. Wind in New York was found to have no disastrous effect on mental quietude, but wind in Denver was associated with five times the normal number of misdemeanors; Dexter suggested that differential moistness of the eastern and western winds might account for this discrepancy.

Certain characteristics pertaining to the procedures used in Dexter's study should be noted. First of all, the criterion for behavior disturbances in the New York schools was the number of demerits received by the students, based upon the teachers' subjective judgments. In Denver, the criterion was instances of corporal punishment for misbehavior occurring in the classroom, as well as that occurring outside of the classroom. Dexter stated that the coldest days may have been assigned greater numbers of behavior disturbances because of snowballing and other activities related to the snow. Second, Dexter recorded weather for the entire 24-hour period during each day, not just the time during which school was in session. Furthermore, for analysis of the data, Dexter used the expectancy curve, which is a comparison of the number of disturbances recorded as compared to the number that would be expected if all days had had an equal number of disturbances. While this approach was productive of graphical illustrations, probability levels were not tabulated.

Although there is little agreement among the studies cited as to the influence of weather upon behavior, the results of several of the cited studies indicate a definite possibility that such factors are in operation. If a clear-cut relationship between weather phenomena and human behavior could be established, the case for controlled atmosphere in industry, commerce, and education would be strengthened. In the area of education, classroom procedures and learning tasks could be varied in accordance with the weather. This dimension could provide for insights into misbehavior and might enable school personnel to deal with such misbehavior more effectively.

The purpose of the present investigation was to gather information pertaining to the relationship of various weather phenomena and disruptive behavior in the classroom. It was intended that the present study differ from that reported by Dexter (1899) in these respects: (1) that behavior disturbances be objectively described; (2) that weather phenomena be recorded only for the time that school is in session; and (3) that specific probability levels for occurrence of behavior disturbances under certain weather conditions be recorded.

Hypothesis

After consideration of the foregoing investigations, it is hypothesized that there is no significant correlation between occurrence of weather phenomena and incidence of disruptive behavior in the classroom. A probability of $< .05$ is here considered sufficient grounds for rejection of the null hypothesis.

CHAPTER II

METHOD

Subjects

The subjects (Ss) in Group 1 included all students enrolled in a class for primary educable mentally retarded pupils at Edmonds Elementary School in Edmonds School District Number 15 in Washington State during all or any portion of the school year from October 1, 1968, to May 29, 1969. Eleven students were enrolled in this class during most of that period. At the beginning of the recording period, their ages ranged from seven to eight years.

The primary educable students enrolled in Snoline Elementary School in Edmonds School District for all or any portion of the school year from October 1, 1968, to May 29, 1969, comprised Group 2. At the beginning of the recording period, their ages ranged from seven to ten years. Eleven students were enrolled in this class during most of the recording period.

The term "primary educable" was used in accordance with classifications made by the special education department of the Edmonds School District.

Procedure

The teacher for the students in Group 1 (E-1) and the teacher for the students in Group 2 (E-2) each recorded specific behavior disturbances from October 1, 1968, to May 29, 1969. A tally of disturbances was kept on a small hand-actuated mechanical counter worn on the wrist. During the months in which data were collected, the Es refrained from discussing tabulations and impressions about the study with one another.

No attempt was made to insure uniformity in the school program from day to day. Furthermore, no attempt was made to equate the programs in the two classrooms or teacher behaviors.

Disruptive behaviors included all instances in which (1) a child spoke out loud without the permission of the teacher; (2) one child was hurt by another child, as evidenced by the teacher's observation or by the child's report; (3) one child took another's possession without permission, and the owner attempted to retrieve the possession by asking the child for the possession, by telling the teacher, or by attempting to take the possession away from the child; (4) a child had a tantrum; (5) a child cried; and (6) talking and/or noise from the children in the classroom was heard by the teacher five seconds after she had issued a request for silence. Behavior disruptions were recorded only during the time in which the class was in session, thereby excluding recesses, passing periods, time before the tardy bell rang, and time after the dismissal bell rang. For both classes, the school day commenced at 8:30 a.m. The children were dismissed at 1:00 p.m.

When two or more instances of disruptive behavior occurred in conjunction with the same incident, one behavior disruption was counted. Although it also would have been logical to count each disruptive behavior, regardless of whether or not it had occurred in association with another disruptive behavior, it was decided to count but one disruption to the class, regardless of the number of component "symptoms."

At the termination of the school year, specific data regarding weather conditions were obtained from the tabulations made by the Seattle-Tacoma Airport, located approximately twenty-five aerial miles from the two schools. The two schools are approximately one aerial mile apart. Ten weather conditions were determined from the airport records for each school day. Unless specified otherwise, the weather conditions were recorded on the hour from 7:55 a.m. to 11:55 a.m. and were averaged. The weather conditions included (1) temperature; (2) the difference between the highest temperature and the lowest temperature; (3) the difference between the temperature recorded at 9:55 a.m. and the temperature recorded at 9:55 a.m. of the previous day; (4) wind velocity; (5) the difference between the highest wind velocity and the lowest wind velocity; (6) cloud cover; (7) barometric pressure; (8) the difference between the highest barometric pressure and the lowest barometric pressure and whether the pressure consistently rose, fell, or varied; (9) relative humidity; and (10) the total amount of precipitation. Adjustment was made in the recording of time during the period in which Pacific Daylight Saving Time was in effect.

Because the school children attended classes only five days during the month of June and because the first month and the final weeks of the school year have commonly been associated with a disproportionately large incidence of disruptive behavior, the present study excluded September and June from consideration. All Mondays throughout the entire recording period were also excluded because scheduled swimming lessons for the groups occupied most of the morning.

CHAPTER III

RESULTS

A _t_ test indicated that significantly fewer behavior disruptions were reported by _E_-1 than by _E_-2 for six of the eight months ($p < .001$). For the first two months during which behavior disruptions were recorded, no significant differences between the two groups were indicated ($p > .05$). (See Table 1.)

Table 1

Comparison of Scores for Group 1 and Group 2

Month	_t_ Score	df
October	1.52 -	32
November	1.45 -	28
December	6.36 *	22
January	5.38 *	20
February	9.89 *	30
March	8.11 *	30
April	9.17 *	26
May	8.75 *	32

- not significant $p > .05$
* probability .001

The mean number of behavior disturbances recorded for Groups 1 and 2 are presented in Figure 1 for each of the eight months during which recordings were made.

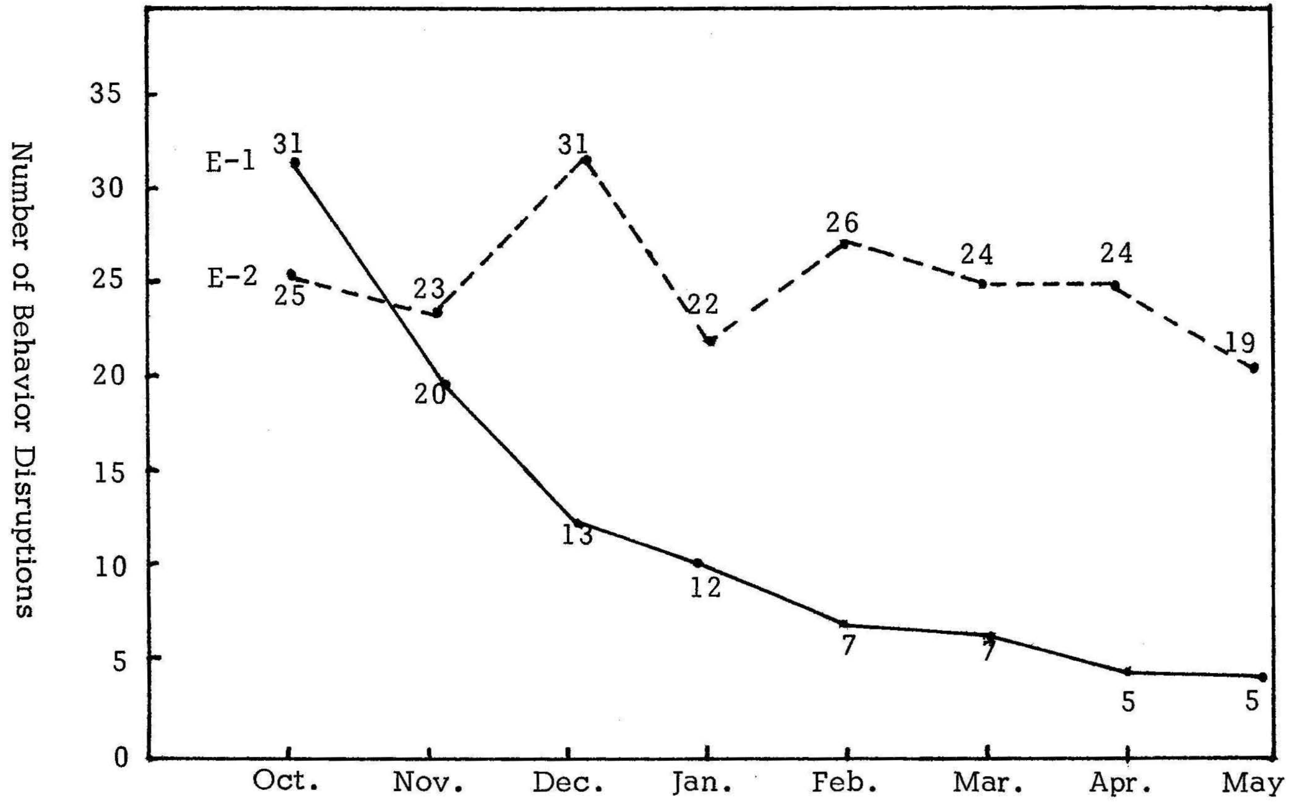

Figure 1. Behavior Disruptions Recorded by E-1 and E-2

For Group 1, a multiple correlation with regression technique revealed that the most significant weather variable was average relative humidity. The greater the average relative humidity for the school day, the greater the number of behavior disturbances ($F = 24.31$; $p < .001$). Other weather variables were not statistically significant in the initial analysis. However, with the deletion of the relative humidity variable, cloud cover emerged as another significant variable ($F = 9.39$; $p < .01$). The greater the average cloud cover, the larger was the number of behavior disturbances.

With the variables of average relative humidity and average cloud cover deleted, temperature change during the day was shown to be a significant variable ($F = 3.35$; $p < .05$). The data indicated that temperature change and behavior disturbances were inversely related; that is, a small temperature variation was associated with a large number of behavior disturbances, and a large temperature change was associated with a small number of behavior disturbances.

In the data recorded by E-1, the composite effect of all ten weather variables was significant at the .05 level ($F = 3.093$). With the variable of average relative humidity deleted, the composite effect of wind speed change, barometric pressure change, temperature change during the day, wind speed, average temperature, and average cloud cover was significant at the .05 level ($F = 2.34$). With the deletion of the variables of average relative humidity and average cloud cover, the composite effect of average wind speed, average temperature, and temperature increase during the day was statistically significant ($p < .05$). (Refer to Table 2.)

The data collected by E-2 were also analyzed by the multiple correlation with regression technique. The only significant weather variable was temperature variation during the school hours ($F = 9.71$; $p < .01$), the data indicating that temperature variation and behavior disturbance rate were inversely correlated; that is, a small temperature variation was associated with a large number of behavior disturbances and vice versa. The composite effect of average relative humidity, barometric pressure change, average wind speed, wind speed change, and temperature variation during the school hours indicated statistical significance ($F = 2.439$; $p < .05$). (Refer to Table 3, page 18.)

The number of behavior disturbances recorded during the entire eight-month period by E-1 and E-2 correlated significantly ($p < .05$). Correlations for each month are recorded in Table 4, page 19.

The implications of Table 4 are that relatively high behavior disturbances were recorded by E-1 and by E-2 on the same days and that relatively low behavior disturbances were recorded by the two Es on the same days for four of the eight months ($p < .05$). As indicated in Table 1, the actual numbers recorded for the two groups varied significantly ($p < .001$) for six of the eight months, but the relative variations corresponded part of the time. A portion of the data for the month of May will illustrate this distinction. (Refer to Figure 2.)

Table 2

Order of Variable Deletion for E-1

	Analysis 1: All Variables Included	Analysis 2: Variable 9 Deleted	Analysis 3: Variables 6 & 9 Deleted
Composite of Variables Having $p<.05$	1,2,3,4,5,6, 7,8,9,10	1,2,4,5,6,8	1,2,4
1st deletion	2	10	10
2nd deletion	5	3	7
3rd deletion	7	7	8
4th deletion	8	5	3
5th deletion	4	8	5
6th deletion	3	2	4
7th deletion	10	4	1
8th deletion	6	1	2
9th deletion	1	6	
10th deletion	9		

Variable 1: average temperature
Variable 2: temperature change during the day
Variable 3: temperature change from the previous day
Variable 4: average wind speed
Variable 5: wind speed change
Variable 6: average cloud cover
Variable 7: average barometric pressure
Variable 8: net barometric pressure change
Variable 9: average relative humidity
Variable 10: total precipitation

Table 3

Order of Variable Deletion for E-2

	Analysis 1: All Variables Included
Composite of variables having $p<.05$	2,4,5,8,9
1st deletion	7
2nd deletion	3
3rd deletion	6
4th deletion	1
5th deletion	10
6th deletion	9
7th deletion	8
8th deletion	4
9th deletion	5
10th deletion	2

Variable 1: average temperature
Variable 2: temperature change during the day
Variable 3: temperature change from the previous day
Variable 4: average wind speed
Variable 5: wind speed change
Variable 6: average cloud cover
Variable 7: average barometric pressure
Variable 8: net barometric pressure change
Variable 9: average relative humidity
Variable 10: total precipitation

Table 4

Correlation of Scores Recorded by E-1 and E-2

Month	Correlation Required for Significance	Correlation Obtained	df
October	.481	.616 *	16
November	.513	.519 *	14
December	.574	.378	11
January	.601	-.047	10
February	.496	.615 *	15
March	.496	.396	15
April	.530	.644 *	13
May	.481	.034	16

* Significant at .05 level of confidence.

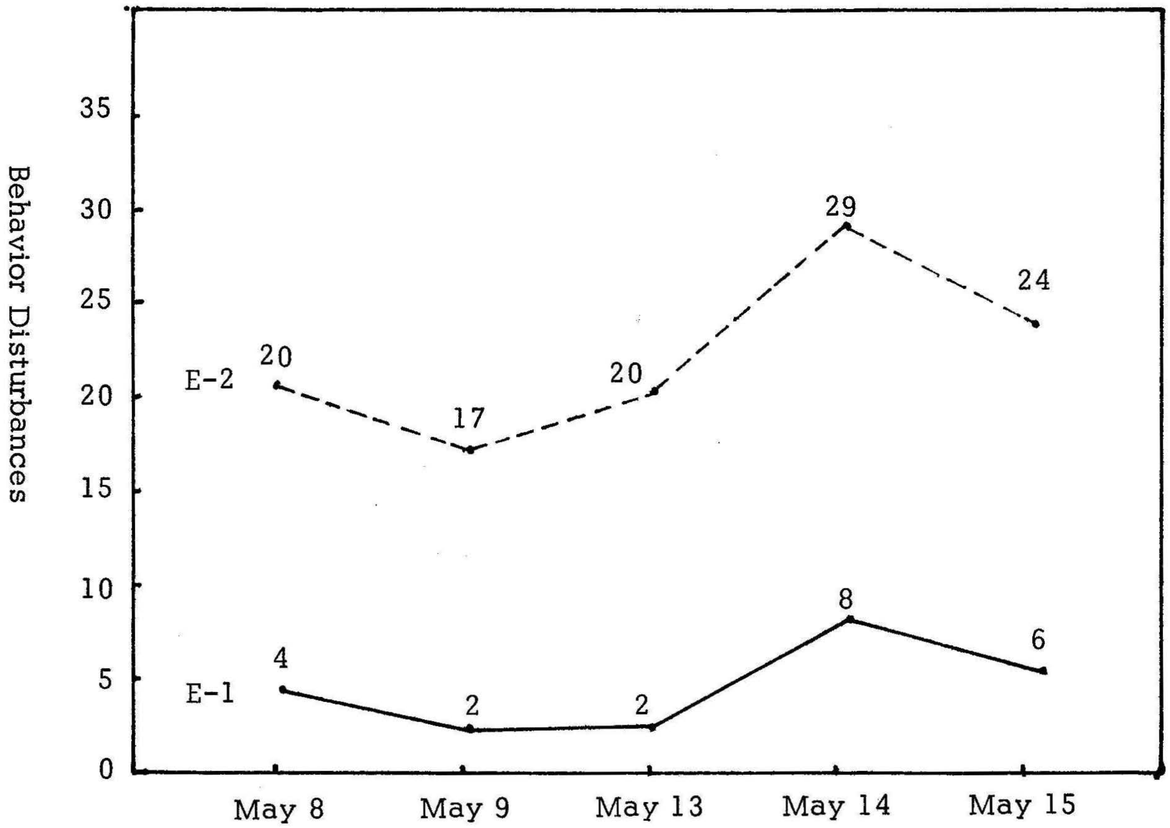

Figure 2. Comparison of behavior disruptions recorded by E-1 and E-2 for five days in May.

CHAPTER IV

DISCUSSION

The results of this investigation indicated that for six of the eight months during which recordings were made, E-1 recorded significantly fewer behavior disturbances than E-2 ($p < .001$). Since the recordings for the first two months were not significantly different at the .05 level of probability, it may be suggested that the children in Group 1 were more influenced by the teacher's requests than the children in Group 2. Another possibility is that the teacher for Group 1 became more skilled in handling disruptive behavior as the year progressed. A third possibility is the variation in behavior-controlling techniques used by the two teachers. In controlling behaviors, both teachers used some of the techniques of operant conditioning, described by Skinner (1953) as a means by which the occurrence of behaviors and their relative frequencies can be controlled. Investigators have utilized operant conditioning principles in the classroom, designated as "behavior modification," to regulate a variety of behaviors. Birnbrauer, Wolf, Kidder, and Tague (1965) found such procedures useful with some retarded students in increasing work efficiency, reducing error rate, and reducing the rate of disruptive behaviors. O'Leary and Becker (1967) used behavior modification based on the principle of operant conditioning to reduce the rate of certain deviant behaviors of an adjustment class comprised of children with emotional problems.

It is pertinent to examine the techniques of behavior modification used by the two teachers who participated in this investigation to see if the variation in number of behavior disturbances may be attributed to differences in technique.

E-1 used a system of behavior modification in which the students earned points which were awarded for completing assignments and for performing such behaviors as E-1 deemed desirable, e.g., attending to classroom presentations and looking at the flag when patriotic songs were sung. When disruptive behaviors occurred, E-1 warned the child or deducted one point from the child's score. Other disciplinary measures, such as removing the child from the classroom, were occasionally employed. At the end of the day, the child was given his choice of candy or pencils if he had earned a sufficient number of points. A further reinforcement was the practice of allowing the students who had lost no points during the day to select each other as seat-mates for the next school day. In other words, only those children who lost no points could sit with another child for the next day, and their choice was restricted to other students who had not lost points.

E-2 awarded points for completion of academic work and for deportment, depending on the child's general behavior, compared with his previous behavior. The points for completion of academic work could be traded for paper money which could be used to buy toys from a classroom store. The points for good behavior could be exchanged for free time.

Both teachers, therefore, utilized behavior-modification techniques. The directness of reinforcement for specific behaviors and the nature of the reinforcer could possibly have accounted for part or all of the variation between the two groups in number of behavior disturbances recorded.

The results of this investigation call for rejection of the null hypothesis which asserted that no significant correlation between occurrence of weather phenomena and incidence of disruptive behavior in the classroom existed. This finding was true for both Group 1 and Group 2. The relative importance of the ten variables was not the same for the two Es, however.

The data collected by E-1 indicated that the weather factors which correlated most highly with the recorded number of behavior disturbances were: (1) average relative humidity ($p < .001$); (2) average cloud cover ($p < .01$); and (3) temperature change during the day ($p < .05$). Average relative humidity and average cloud cover were directly correlated with number of behavior disturbances, and temperature change during the day was inversely correlated with behavior disturbances.

The findings of Dexter (1899) indicated that Denver school children were punished for misdemeanors four times as frequently on days of relative humidity below 30 percent, but he also found a rise in number of behavior disturbances in New York City on days when the relative humidity was 95 to 100 percent. In the present study, only four days of the eight-month period recorded a relative humidity drop below 40 percent, so it is not possible to compare the two studies on this account. However, like the data recorded for New York, the present data indicated a rise in the number of behavior disturbances when the relative humidity was high.

Dexter's (1899) finding that cloudy days were associated with good deportment of students is at odds with the present study. The significance of cloud cover in the present study ranked behind only the significance of relative humidity. With regard to behavior disruptions, the findings of Dexter indicated that fewer disturbances occurred on rainy days, but the findings of E-1 and E-2 did not substantiate this.

Mills (1958) found evidence of greater rate of certain maladaptive behaviors during conditions of low pressure. The data obtained in the present study by E-1 and by E-2 failed to indicate any significant difference related to barometric pressure. Mills (1950, 1953) found poorer intellectual functioning to be associated with heat, but the present study found no relationship between heat and occurrence of behavior disruptions. Dexter's study (1899) also failes to establish a fixed pattern between temperature and children's misbehavior.

Analysis of the data collected by E-2 suggested that days of stable temperature were significantly related to a high rate of behavior disturbances (p .01). E-1 reported similar findings (p .05) after the factors of average relative humidity and average cloud cover had been deleted from consideration. Huntington (1926), in contrast, noted that a rise in temperature was usually accompanied by poor work. However, poor work and rate of behavior disturbances may not be related.

The fact that the number of behavior disturbances recorded by E-1 and E-2 correlated significantly (p .05) for four months out of the eight, and that the two sets of scores correlated significantly as a whole (p .05) gives some weight to the premise that some factor or combination of factors was in operation for both classes. However, it would be erroneous to disregard the possibility that a third factor or combination of factors was in effect. For example, the reaction of the teacher to the weather may have influenced the children's behavior more than weather per se. Mills and Heady (1934) have spoken to this very point:

> Adults themselves are often more affected than the children because of their greater load of care and worry. They should be doubly careful, therefore, not to attribute all the trouble to the children, but realize that they themselves are, on these days, more irritable and short tempered [p. 35].

Dexter (1899) has also noted that certain temperature ranges and low humidity are associated with more accentuated numbers of maladaptive behaviors for adults than for children.

Before the implications for education indicated by this study are examined, it is pertinent to emphasize that the effect of climate upon the impact of local weather phenomena was not examined in this study. For example, the area in which the data for this investigation were collected has a greater annual precipitation total than many other areas, and rainfall may correlate differently with behavior disturbances in an area of small annual precipitation. In Dexter's study (1899), many parallels in relation to behavior disturbances between the dissimilar climates of Denver and New York were reported. However, the presence of wind was associated with behavior disturbances in Denver, but not in New York:

Certain other limitations of the present study should also be noted. Because the schools in which E-1 and E-2 conducted their classes were approximately one aerial mile apart, the weather for the two locations may have differed slightly. Furthermore, the weather recorded at the Seattle-Tacoma Airport, which was approximately twenty-five miles away, may have differed somewhat from that experienced at the two schools.

Room peculiarities may have brought about some discrepancies in the experimental situations. For example, heat pipes ran through the classroom used by E-1 and the classroom was also located across the hall from the boiler room. The heat often made it necessary for windows to be opened, even during the winter months. A fan was sometimes used on hot days, thereby creating an artificial wind. In addition to these factors, the school was located only a few city blocks from Puget Sound. These factors, in combination, cast some doubt upon the validity of the measured relationship between behavior disruptions and relative humidity. The total effect is impossible to ascertain.

No attempt was made to control the consistency of the classroom schedules from day to day. Differences in rate of behavior disturbances might be expected because of this factor alone. However, the effects of this variable possibly were equalized during the course of the year.

A further limitation of this study was the description of the conditions constituting a behavior disturbance. Certain behaviors in the classroom might have been considered to be disturbances, but no provision was made for them in the description of disturbances. It may be assumed that the percent of unrecorded disturbances was more or less equivalent on separate days. On the other hand, some behaviors fitted the classification of a disturbance even when they were, in the teacher's estimation, justifiable, e.g., a pupil yelling to the teacher that a vase would tip over if the curtain were drawn any further. Such cases were the exception, rather than the rule.

Since both Es worked independently, there was no determination of reliability in recording disruptive behavior. Teacher bias may have influenced their perception of behavior disturbances somewhat, although the Es attempted to remain as objective as possible. Preconceived notions about the type of weather phenomena associated with a high rate of behavior disturbance may have caused the Es to relate to the classes in such ways as to expect or actually to elicit behavior disturbances.

The process of measurement may change the behavior which it attempts to measure. Both Es noted that the students responded to the clicking of the golfer's pal recording device. Furthermore, the Hawthorne effect, as described by Roethlisberger and Dickson (1951) may have changed the behavior of the students since their verbal comments indicated that they were aware that the occurrence of misbehavior was being recorded. Unless a way of recording could be devised that would be undetectable to the Ss, this problem is unavoidable.

Conclusions

The results of this investigation give weight to the argument that weather phenomena are associated with variable rates of behavior disturbances in the classroom. The specific phenomena and their respective correlatory levels are not entirely clear. At least some credence is given to the desirability of installing humidity control appliances and temperature regulators in school buildings. Investigation of varying the daily classroom program according to weather phenomena is warranted.

CHAPTER V

SUMMARY

Two teachers of primary special education students classified as "educable" by the Edmonds School District, recorded the occurrence of specific behavior disruptions during the time that class was in session during the months from October, 1968, through May, 1969. Weather phenomena, including mean temperature, temperature change during the day, temperature change from the previous day, average wind speed, wind speed change, average cloud cover, mean barometric pressure, direction and amount of barometric change, average relative humidity, and total precipitation, were recorded for the school hours. These variables were correlated with the recorded number of behavior disturbances for each day, using a multiple correlation with regression technique. For _E_-1, significant variables were average relative humidity ($p < .001$), average cloud cover ($p < .01$), and temperature change during the day ($p < .05$). For _E_-2, a significant variable was temperature variation during the school day ($p < .01$). Relative humidity and cloud cover were found to be directly related to number of behavior disturbances for _E_-1, and temperature variation was inversely correlated with number of behavior disturbances for both _E_s. The correlation between the number of behavior disturbances recorded by the two Es for the eight months was significant at the .05 level of confidence. Dexter (1899) reported dissimilar findings regarding cloud cover and relative humidity. Other literature has not spoken directly to behavior of school children. Further investigation on this topic is warranted.

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APPENDICES

APPENDIX A

RAW DATA

The raw data is presented in tabulated form on the pages that follow. To conserve space, the Variables columns were headed by numbers only. Following is an explanation of information contained in each column:

Variable 1: Average temperature
Variable 2: Temperature change during the day
Variable 3: Temperature change from the previous day
Variable 4: Average wind speed
Variable 5: Wind speed change
Variable 6: Average cloud cover
Variable 7: Average barometric pressure
Variable 8: Net barometric pressure change (+ means consistent rise; - means consistent drop)
Variable 9: Average relative humidity
Variable 10: Total precipitation

APPENDIX A

RAW DATA

Date	Disturbances		Variables									
Oct.	E-1	E-2	1	2	3	4	5	6	7	8	9	10
1	24	10	254	6	+1	29	3	50	1134	+24	400	0
2	31	14	233	12	-6	36	6	49	1198	- 4	437	0
3	18	13	239	10	+5	18	7	45	631	-14	474	0
* 4	40	14	272	8	13	52	6	43	852	+43	394	T
* 7	31	11	246	3	-3	26	4	44	1010	+12	403	0
8	28	10	223	8	-5	16	6	46	1098	24	463	0
9	30	37	229	4	0	37	3	50	670	11	472	0
10	37	30	247	3	+6	75	2	50	441	+25	446	.02
11	25	25	251	4	+1	36	4	50	-114	-48	388	.02
*14	26	22	244	1	+2	42	4	50	145	+14	384	T
15	28	29	249	5	0	49	4	46	747	+37	455	0
16	37	16	234	11	-3	32	3	49	1330	7	409	0
17	24	14	247	9	+3	17	6	45	787	-14	422	0
*21	16	23	235	5	-3	30	9	50	1008	-29	411	0
22	45	47	252	4	+4	22	10	50	1105	+16	482	0
23	34	48	276	6	+5	28	3	49	1144	+ 3	428	0
24	45	33	262	8	-4	19	6	16	1019	-17	476	0
25	36	32	273	3	+4	59	4	50	1076	+38	493	T
*28	23	44	285	7	+1	22	6	50	543	-29	336	0
29	24	22	291	6	-2	73	8	35	61	16	345	.04
30	28	32	256	4	-5	73	1	45	515	+34	338	0
31	26	19	233	7	-4	24	1	43	1136	5	335	0

* Data not included in study.

RAW DATA (Continued)

Date Nov.	Disturbances E-1	E-2	Variables 1	2	3	4	5	6	7	8	9	10
1	36	39	216	9	-5	30	5	49	985	18	428	0
* 4	24	23	207	10	-7	16	3	50	835	+ 5	462	0
5	21	33	228	7	+6	21	7	50	1098	+14	385	.01
6	17	18	219	10	-3	21	5	50	987	13	411	0
7	22	25	249	5	+7	27	3	47	1127	7	295	0
8	19	18	259	6	+2	49	10	50	766	18	471	T
12	19	33	230	2	-9	70	11	48	538	+28	421	0
13	24	21	212	6	-4	42	5	49	1102	9	413	0
14	12	20	208	8	0	32	3	48	550	-41	318	0
15	17	21	207	2	-1	63	6	50	175	+14	422	T
*18	10	12	244	2	+4	42	3	50	851	+ 9	457	.06
19	26	17	263	8	+3	20	2	48	1043	10	413	0
20	18	18	270	3	+3	73	3	37	1098	27	434	0
21	19	20	247	-1	-6	65	8	50	589	35	436	.08
22	14	17	251	5	+1	77	4	43	1090	21	409	T
*25	6	12	222	3	+1	32	5	50	1413	+23	463	0
26	18	19	219	5	-1	38	4	50	1198	-42	463	0
27	12	26	238	1	+3	67	9	47	1313	+23	436	0

* Data not included in study.

RAW DATA (Continued)

Date	Disturbances		Variables									
Dec.	E-1	E-2	1	2	3	4	5	6	7	8	9	10
* 2	6	23	201	6	+1	43	2	50	1146	7	460	.02
3	21	31	249	2	+9	108	6	50	812	-28	457	.39
4	17	43	182	2	-14	37	5	48	1167	-38	430	0
5	8	21	203	1	+5	97	6	28	831	+44	368	0
6	19	47	181	7	-5	27	5	50	1329	-28	399	0
* 9	6	23	232	2	+3	81	11	50	418	+30	416	.03
10	9	27	214	2	-2	35	5	50	-360	17	477	.26
11	11	27	206	1	-2	46	7	50	427	+43	464	.03
12	12	15	189	6	-3	16	6	30	1241	9	438	0
13	13	46	229	1	+8	77	7	50	211	7	220	T
*16	4	34	196	2	-12	44	3	50	796	+14	424	T
17	12	30	187	1	-3	32	2	50	1311	17	417	T
18	11	41	170	-2	-3	44	3	49	702	10	469	.02
19	15	29	152	3	-5	28	4	23	979	17	443	0
20	7	29	141	1	-1	29	2	48	1121	7	468	0

* Data not included in study.

RAW DATA (Continued)

Date	Disturbances		Variables									
Jan.	E-1	E-2	1	2	3	4	5	6	7	8	9	10
2	10	33	194	2	-2	15	7	49	1355	17	439	0
3	15	25	197	1	+1	47	4	50	1239	14	422	.01
* 6		5	204	-1	-6	32	2	50	770	-26	481	.20
8	13	16	178	2	-2	59	6	50	944	-11	444	0
9	12	21	197	2	+4	67	2	50	-016	7	429	.12
10	14	28	203	2	+1	75	6	50	-258	-20	405	.02
*13	7	21	178	4	+2	33	5	50	-031	7	448	.03
*14	8	35	186	4	+1	77	7	38	477	+25	391	T
15	21	50	179	2	-2	52	2	49	514	+17	409	T
16	13	16	172	1	0	58	4	50	656	-14	474	.05
17	8	15	170	2	-1	58	10	46	928	+17	398	0
*20	3	21	159	4	-1	21	4	49	68	7	298	0
21	7	28	141	1	-3	51	9	44	147	10	313	T
22	13	23	128	2	-3	45	4	39	804	31	289	T
23	11	17	119	5	-2	15	5	49	1303	-17	267	0
*27	8	19	130	0	+2	39	5	50	46	16	345	.04
28	11	20	98	2	-7	42	1	40	539	15	361	T

* Data not included in study.

RAW DATA (Continued)

Date	Disturbances		Variables									
Feb.	E-1	E-2	1	2	3	4	5	6	7	8	9	10
* 3	5	11	211	4	+6	43	1	50	988	-17	369	.02
4	7	21	193	-6	-4	46	4	50	241	10	427	.32
5	1	14	176	6	-2	19	3	18	392	11	354	0
6	4	11	171	7	-2	50	2	11	312	+15	333	0
7	7	31	190	6	+3	41	2	50	669	12	301	T
*10	5	13	238	6	+8	58	5	50	473	-22	371	.06
11	7	32	227	1	-3	60	5	50	422	+27	460	.05
12	9	31	195	7	-7	29	7	43	515	+ 6	450	0
13	5	32	196	7	0	41	4	48	743	6	409	0
14	6	25	227	5	+7	58	3	50	228	4	230	0
*17	6	21	231	11	0	30	3	50	823	7	289	0
18	11	36	217	11	-3	28	2	37	794	15	342	0
19	6	22	206	9	-2	26	4	19	626	8	374	0
20	6	33	196	4	-2	37	3	36	822	5	395	0
21	9	25	189	10	-2	14	4	30	819	- 9	409	0
*24	2	25	212	15	+5	59	7	3	65	-23	282	0
25	6	20	211	7	0	17	6	42	120	-10	349	0
26	11	30	214	11	+1	30	2	38	536	+22	316	0
27	6	26	229	10	+3	60	9	18	659	25	227	0
28	8	20	228	11	-1	26	2	47	368	3	278	0

* Data not included in study.

RAW DATA (Continued)

Date	Disturbances		Variables									
Mar.	E-1	E-2	1	2	3	4	5	6	7	8	9	10
* 3	14	20	217	1	-10	30	4	50	1137	+24	444	.01
4	11	22	214	5	0	49	9	48	1282	-17	419	0
5	8	34	226	3	+1	78	6	43	419	5	424	.07
6	10	36	209	5	-3	16	7	49	822	- 3	446	.06
7	8	20	204	13	0	27	3	8	924	10	377	0
*10		20	225	9	+3	55	5	1	1167	-15	168	0
11	6	29	214	12	-2	17	2	0	1178	+ 1	220	0
12	6	25	209	13	-2	28	6	1	1437	- 3	308	0
13	4	17	215	12	+2	18	6	2	1341	7	321	0
14	5	25	215	10	-1	37	7	50	1303	7	316	0
*17	5	14	254	4	+6	59	5	47	679	4	412	.09
18	8	26	216	5	-9	33	11	50	934	+36	450	.01
19	5	20	227	4	+2	51	5	45	1418	- 4	399	0
20	2	15	232	12	+2	62	3	15	1125	-15	375	0
21	5	17	232	12	0	24	4	43	924	9	353	0
*24	6	35	230	14	-2	40	5	7	1699	-19	311	0
25	7	42	258	13	+6	54	5	17	1346	- 5	254	0
26	8	12	264	14	+1	17	5	47	1192	-15	297	0
27	6	17	246	1	-4	49	5	50	1089	+13	344	0
28	5	23	217	9	-7	28	3	40	1026	- 9	461	0

* Data not included in study.

RAW DATA (Continued)

Date	Disturbances		Variables									
April	E-1	E-2	1	2	3	4	5	6	7	8	9	10
* 7	2	15	229	8	-1	26	3	48	1242	11	370	0
8	8	28	264	16	+7	17	8	39	856	18	323	0
9	8	25	263	5	+3	40	6	49	910	+10	273	0
10	2	13	250	8	-5	31	2	42	1342	6	329	0
11	5	23	272	13	+5	23	3	14	1159	-21	308	0
*14	3	24	244	9	0	21	5	37	1019	2	333	0
15	4	27	252	5	+1	36	2	28	1411	10	361	0
16	6	38	259	9	+1	33	3	50	1233	10	336	0
17	4	17	263	4	+1	35	3	50	589	-38	427	.01
18	5	20	245	8	-4	93	3	44	796	+16	380	0
*21	2	14	280	14	+6	32	8	36	748	- 9	330	0
22	1	14	249	6	-6	68	3	50	575	-33	389	0
23	4	27	250	5	+1	51	4	50	256	+11	384	T
24	5	19	239	5	-5	73	5	42	965	+25	345	T
25	4	20	233	8	+2	34	5	24	1467	- 3	326	0
*28	5	5	248	1	-6	52	8	50	674	-23	400	.04
29	6	28	223	6	-6	72	2	50	844	+ 7	365	0
30	6	37	212	3	-2	19	6	50	760	7	377	0

* Data not included in study.

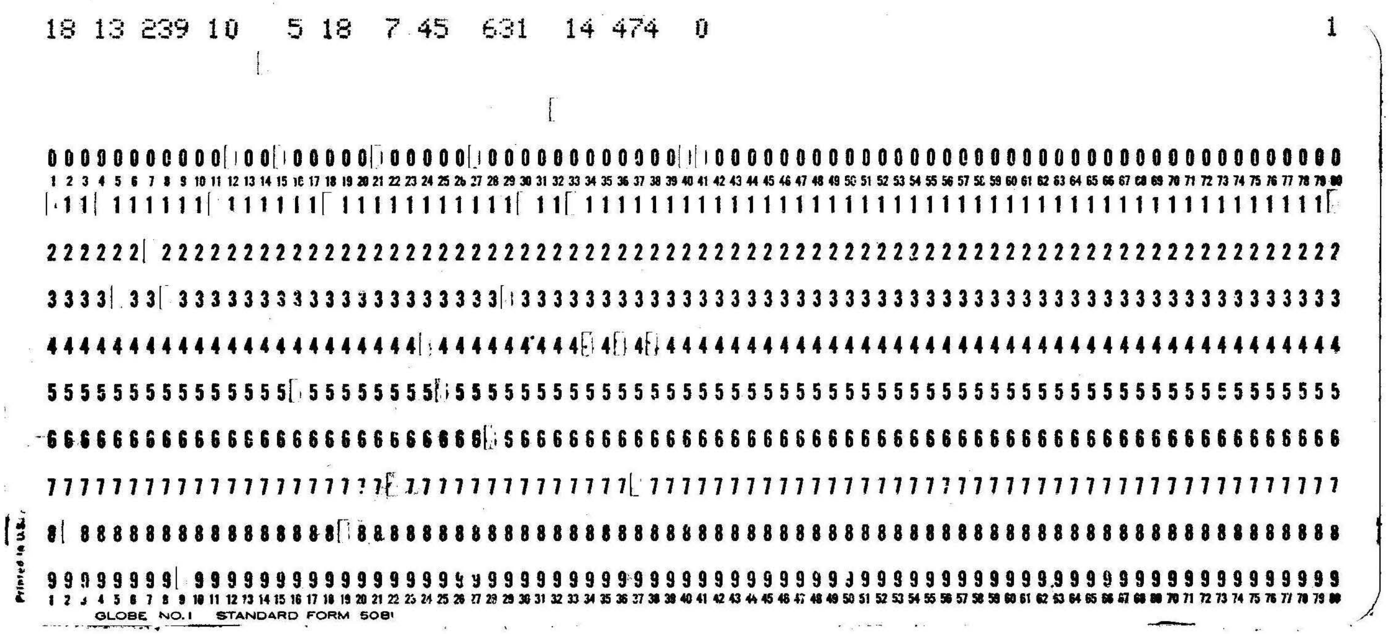
RAW DATA (Continued)

Date	Disturbances		Variables									
May	E-1	E-2	1	2	3	4	5	6	7	8	9	10
1	4	20	215	5	0	38	3	50	906	+18	420	.04
2	0	23	212	3	-1	37	3	50	1048	+ 6	408	T
* 5	6	23	268	11	+5	38	2	47	1179	- 3	267	0
6	6	29	281	9	+2	38	4	0	1144	3	314	0
7	6	14	299	12	+4	57	4	0	1102	8	298	0
8	4	20	327	16	+6	33	3	0	1034	4	265	0
9	2	17	271	6	+8	34	4	50	1256	6	401	0
12	0	18	297	9	+3	29	4	30	740	0	331	0
13	2	20	293	10	-1	30	6	50	678	6	357	0
14	8	29	261	6	-6	60	6	48	900	+12	319	0
15	6	24	253	10	-1	24	2	0	990	- 6	336	0
16	7	11	280	11	+4	21	1	46	989	11	347	0
*19	1	10	268	4	-11	41	3	50	858	+20	432	0
20	6	15	279	6	+2	27	4	48	1136	2	402	0
21	4	13	311	16	+7	42	5	2	1056	-14	352	0
22	1	10	343	15	+7	27	4	17	791	-13	298	0
23	10	12	372	15	+6	24	5	11	488	-16	254	0
*26	5	12	288	11	+1	48	9	34	486	- 5	350	0
27	4	24	273	8	-4	56	11	50	1702	+23	390	.02
28	9	21	271	6	0	25	4	50	1077	5	354	T
29	6	17	278	3	+2	55	3	50	892	5	480	.09

*Data not included in study.

APPENDIX B

SAMPLE OF COMPUTER CARD USED IN PROCESSING DATA



APPENDIX C

SAMPLE OF FEED-OUT SHEET OF DATA PROCESSED BY A MODEL 1620 COMPUTER

	MEAN	STD DEV	VAR	ST ER
V(1)	6.500	2.280	5.199	.570
V(2)	23.750	8.193	67.133	2.048
V(3)	224.875	17.689	312.916	4.422
V(4)	8.937	4.343	18.862	1.085
V(5)	-.875	3.667	13.450	.916
V(6)	36.750	18.487	341.799	4.621
V(7)	5.437	2.337	5.462	.584
V(8)	31.750	20.315	412.733	5.078
V(9)				
ERROR F8 .11100000E+04				
		265.499	70489.746	66.374
V(10)	-1.250	12.358	152.733	3.089
V(11)	360.250	71.451	5105.266	17.862
V(12)	.875	2.217	4.916	.554
U(1)	6.500	2.280	5.199	.570
U(2)	23.750	8.193	67.133	2.048
U(3)	224.875	17.689	312.916	4.422
U(4)	8.937	4.343	18.862	1.085
U(5)	-.875	3.667	13.450	.916
U(6)	36.750	18.487	341.799	4.621
U(7)	5.437	2.337	5.462	.584
U(8)	31.750	20.315	412.733	5.078
U(9)				
ERROR F8 .11100000E+04				
		265.499	70489.746	66.374
U(10)	-1.250	12.358	152.733	3.089
U(11)	360.250	71.451	5105.266	17.862
U(12)	.875	2.217	4.916	.554

T-TEST RESULTS

V(1)-U(1)	.00000000	WITH	30	DF
V(1)-U(2)	-8.11296970	WITH	30	DF
V(1)-U(3)	-48.97446600	WITH	30	DF
V(1)-U(4)	-1.98762410	WITH	30	DF
V(1)-U(5)	6.83097370	WITH	30	DF
V(1)-U(6)	-6.49562030	WITH	30	DF
V(1)-U(7)	1.30154560	WITH	30	DF
V(1)-U(8)	-4.94046550	WITH	30	DF
V(1)-U(9)	-16.62468100	WITH	30	DF
V(1)-U(10)	2.46674800	WITH	30	DF
V(1)-U(11)	-19.79366300	WITH	30	DF
V(1)-U(12)	7.07397950	WITH	30	DF
V(2)-U(1)	8.11296970	WITH	30	DF
V(2)-U(2)	.00000000	WITH	30	DF
V(2)-U(3)	-41.26726500	WITH	30	DF
V(2)-U(4)	6.38924670	WITH	30	DF
V(2)-U(5)	10.97270300	WITH	30	DF
V(2)-U(6)	-2.57144410	WITH	30	DF
V(2)-U(7)	8.59709650	WITH	30	DF
V(2)-U(8)	-1.46079640	WITH	30	DF
V(2)-U(9)	-16.35761900	WITH	30	DF
V(2)-U(10)	6.74404270	WITH	30	DF
V(2)-U(11)	-18.71539600	WITH	30	DF
V(2)-U(12)	10.77963600	WITH	30	DF
V(3)-U(1)	48.97446600	WITH	30	DF
V(3)-U(2)	41.26726500	WITH	30	DF
V(3)-U(3)	.00000000	WITH	30	DF