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CLASSROOM CLIMATE AND GROUP LEARNING.

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TO INVESTIGATE THE RELATIONSHIP BETWEEN EMOTIONAL CLIMATE AND LEARNING, RANDOM SAMPLES OF STUDENTS IN 49 TWELFTH GRADE PHYSICS CLASSES FROM ALL PARTS OF THE COUNTRY WERE GIVEN A CLASSROOM CLIMATE QUESTIONNAIRE WHICH WAS CORRELATED WITH THE TEST ON UNDERSTANDING SCIENCE, A PHYSICS ACHIEVEMENT TEST, AND THE SEMANTIC DIFFERENTIAL FOR SCIENCE STUDENTS. A 25 PERCENT RANDOM SAMPLE OF EACH CLASS TOOK THE CLASSROOM CLIMATE QUESTIONNAIRE WHILE A 50 PERCENT RANDOM SAMPLE TOOK THE THREE TESTS. USING MULTIPLE CORRELATION AND CANONICAL CORRELATION TECHNIQUES, CLASSES WITH HIGH GAINS IN SCIENCE UNDERSTANDING WERE PERCEIVED BY THE STUDENTS AS CONTAINING MORE FRICTION, STRICT CONTROL, AND PERSONAL INTIMACY AND LESS STRATIFICATION, GOAL DIRECTION AND SUBSERVIENCE THAN CLASSES HAVING LOW GAINS. DISORGANIZATION, FORMALITY, AND SOCIAL HETEROGENEITY WERE IN DESCENDING ORDER OF IMPORTANCE, NEGATIVELY RELATED TO PHYSICS ACHIEVEMENT GAINS. IQ SCORES WERE FOUND TO HAVE LITTLE RELATIONSHIP TO THE 3 CRITERION MEASURES. LEARNING SITUATIONS WERE SEEN AS THOSE HAVING INTENSE INTERACTION BETWEEN TEACHER AND STUDENTS, WITH THE CLASS BEING WELL ORGANIZED AND CONTROLLED BY THE TEACHER BUT WHERE THE STUDENTS WERE FREE TO QUESTION AND LEARN IN A RELATIVELY INFORMAL ATMOSPHERE. (AF)

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Classroom Climate and Group Learning

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A recent study (Walberg and Anderson, 1967) analyzed the relationship of individual student perceptions of the socio-emotional climate of their class to cognitive, affective, and behavioral learning outcomes. The present study completes the series of exploratory researches by relating class means on the first form of the Classroom Climate Questionnaire (Walberg, 1966) to learning. Two prior group studies (Walberg, 1968; Walberg and Anderson, 1968) have been done as shown below:

Input	Throughput	Output
September Pretests	November Midtests	May Posttests
Personality and Cognitive Measures	Classroom Climate	Class Learning
Teachers →	Group Perceptions of the Class →	Understanding
		Achievement
Students →		Attitude

[1]This research is part of the evaluation of Harvard Project Physics, a course development project supported by the Carnegie Corporation, the National Science Foundation, the Sloan Foundation, and the U.S. Office of Education.

The solid lines refer to relationships that have already been established for groups; the broken line refers to the purpose of this study: to relate class gains in understanding, achievement, and attitude to group perceptions of classroom climate. The reader is referred to our previous studies for the rationale of the research series.

Method

Subjects

The students included in the sample were those students trying out an experimental physics course. The mean Henmon-Nelson IQ for the 49 classes in the sample was 115 (s.d.=9.3), corresponding to the 84th percentile of grade 12 students. Approximately 61% of the students were male. The teachers were volunteers from all parts of the country and do not represent a random sample since they were carefully selected and have been found to resemble creative scientists to a greater extent than do random samples of physics teachers (Walberg and Welch, 1967a). Hence, the authors wish to emphasize that this is a preliminary study and will be replicated with a more appropriate sample in the near future.

Instruments

The Classroom Climate Questionnaire (Walberg, 1966) contains 80 items distributed over 18 factor analytically derived dimensions. Students respond by agreeing or disagreeing on a five-point scale with these 80 items. A typical item on the Disorganization scale is, "There are long periods during which the class does nothing." Other examples are offered in Walberg and Anderson (1968). For the present group study the 14 scales with reliabilities over .40 were included as shown in Table 1. The inter-rater reliabilities calculated using Fisher's intraclass correlation (Anderson, 1967) range from .40 to .78. A revised and hopefully more reliable instrument has been developed and will be used to replicate our work of this year.

The three criterion measures are the Test on Understanding Science, a Physics Achievement Test and the Semantic Differential for Science Students. The Test on Understanding Science (Cooley and Klopfer, 1961) is a 60-item multiple choice test which measures understanding of scientific processes. The Physics Achievement Test (Ahlgren, Walberg and Welch, 1966), a 36-item multiple choice test, is designed to measure general knowledge of physics. The Semantic Differential for Science Students (Ahlgren, Geis, Walberg and Welch, 1966) is similar to the instrument developed by Osgood, Suci and Tannenbaum (1957). The concept selected was "Myself as a Physics Student--Pleasurable." It is assumed that this concept indicates the attitudes of the students towards studying physics. The standard errors of the pre and posttest class means for the three criteria are listed in Table 1.

It is well known that student learning is a function of IQ. Although much of the effect of IQ was eliminated when the pretest score was subtracted out, the class mean Henmon-Nelson IQ score was added to the predictor battery of climate scores in an attempt to determine the amount of predictable criterion variance not attributable to IQ alone.

Procedure

To collect the data a system of randomized data collection was employed that maximized the number of tests and minimized testing time for individuals by having random groups of students within each class take several different instruments (Walberg and Welch, 1967b). In any one class, a random quarter of the students took the measure of socio-emotional climate and the IQ test and a random half, the pre and post measures which were used for the criterion. These samples of the students within each class were used to estimate the class means which became the units of analysis. Simple differences of pre and post class means were used as criteria.

The inter-correlations of the 14 predictors and 3 criteria were calculated and used to obtain multiple correlations of the climate predictors on each of the criteria. Secondly, a similar multiple correlation was calculated for the measure of Physics Achievement by adding the full 14 climate predictors to the IQ predictor in order to test for a significant increase in the correlation over IQ alone. Finally, canonical correlations

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were calculated between all the climate measures and the three criteria.

Results and Discussion

Table 1 shows the simple correlations of all the predictors and criteria and Table 2 includes the three multiple correlations together with the beta-weights for each climate predictor. The multiple correlations for Science Understanding, Physics Achievement and the Semantic Differential are .57, .68 and .59, respectively; the squares of the multiple correlations indicate that the weighted battery of class mean climate scores predict 33, 46 and 34 percent of variance in the three criterion measures.

It should be noted that only the multiple correlation for Physics Achievement is statistically significant (p=.04). The relationships of climate scores to Science Understanding and the Semantic Differential changes have probabilities of .34 and .27. While these probabilities are greater than the normal .05 level, the lack of statistical significance is not considered a serious drawback in this exploratory study as it is a result of the method of analysis which employed all 14 scales in the predictor battery. We considered it preferable to use all 14 classroom climate measures as our purpose was to gain understanding of the relationships rather than to predict learning. For the latter purpose, a step-wise procedure may be appropriate.

Such a step-wise method shows significant relationships for an optimally reduced predictor set. For example, the two best climate predictors of gains in Science Understanding (Friction and Personal Intimacy), yield a correlation of .37. For the Semantic Differential changes (using Stratification and Subservience), the multiple correlation is .52. These correlations are significant beyond the .05 and .001 levels, respectively, using two degrees of freedom in the predictor set. If the relationships are as strong in later work as they were here, correlations and significance levels should be similar to those just described, and higher if more refined and reliable scales are employed.

The nature of the relationships is also meaningful. Classes with high gains in Science Understanding are perceived by the students as containing more Friction, Strict Control and Personal Intimacy and less Stratification, Goal Direction and Subservience than classes having low gains. Classes in which students are gaining more in understanding science may have friction over scientific ideas and yet retain personal intimacy among the class members. The teacher may have to impose stricter discipline, yet less goal direction. The students perceive neither subservience to their teacher nor social stratification among themselves. This interpretation is consonant with a previous study (Walberg and Anderson, 1968) of "creative" versus "achieving" classes.

Physics Achievement is more highly related to student perceptions of climate than are the other criteria. The correlations and beta-weights for Physics Achievement indicate that Disorganization, Formality and Social Heterogeneity are, in order of importance, negatively related to achievement gains. Administrators have long used disorganization as a criterion for teacher effectiveness, evidently with some justification if achievement is the chief goal of the school. The loading on Formality may imply that too many rules hinder cognitive learning and the high loading of Social Heterogeneity may be a reflection of school socio-economic status.

The changes on the Semantic Differential measure were most highly related to Stratification which itself correlates -.49 with this measure of change. Apparently when there is a perceived social hierarchy and role segregation among the class members, the class as a whole tends to gain less interest in the subject.

In order to investigate the possibility that the climate scores were predicting no variance independent of IQ, the class mean Henmon-Nelson IQ score was added to the predictor battery. Table 1 shows that IQ correlates only -.04, .26 and .06 with Science Understanding, Physics Achievement and Semantic Differential changes. It was considered meaningful to determine how many of the climate scales were contributing new information for the prediction of Physics Achievement, and so the 14 climate measures were added to IQ in the predictor battery. IQ by itself shares less than 7 percent of the variance in Physics Achievement while 46 percent common variance is produced for the 15 predictor battery.* This increase in variance is not significant for the full 14 climate predictors (using Guilford's 1954 F-test), as several climate scales do not correlate with the criterion. However, the best 9 climate predictors jointly produce a significant increase in the multiple correlation ($F_{8,38}$=3.26) at the .01 level and the best 11, contribute additional prediction at the .05 level ($F_{10,36}$=2.10). IQ correlates -.44 with Social Heterogeneity. Hence, it is suspected that, like Social Heterogeneity, a large portion of IQ's predictiveness is merely a result of its indication of socio-economic status of the school.

We consider it essential to use more than one criterion of learning effectiveness and also carried out a canonical analysis to explore a multidimensional model of learning. The reader is referred to Walberg and Anderson (1968) for an explanation of the statistics used. The canonical analysis incorporates a three dimensional gain criterion. Generally,

*There was no increase in the multiple correlation using 15 predictors over the correlation for the 14 climate predictors. The beta-weight for IQ was .01.

such a criterion presents problems because optimal statistical weightings often bear little relationship to pedagogical principles. However, here this is not the case. Table 2, which lists the first two canonical variates (significant at the 0.04 and 0.06 levels), shows that for the first variate, the gains are weighted equally. The predictor battery shares 51 percent of the variance in a complex criterion made up of the three equally weighted change measures. If the results withstand the test of cross-validation, the pattern of high scores on Friction, Personal Intimacy and Strict Control, and low scores on Disorganization, Stratification, Subservience and Formality is the one most significantly related to collective gains on the three criterion measures. The opposite loadings of Formality and Strict Control may be an artifact of this particular sample since these measures themselves are highly correlated (r=.56). Guilford (1954) has pointed out that correlated predictors should be added in subsequent regression studies, so these scales have been merged on the revised instrument. The other loadings indicate that classes containing students who fight among themselves (hopefully about such things as how to solve the problem or do the lab) and yet are personally intimate, learn more than classes where there is less fighting (and perhaps less interacting) and less Personal Intimacy. Classes perceived as being less Disorganized, Stratified and Subservient also tend to have higher criterion scores. For effective learning on the three criteria considered collectively, the pattern implies that all the students should participate equally in the class activities, that aggressive and intimate impulses must be given some free rein, and, probably related to teaching style, that the class must be well organized and controlled but not subservient and formal.

The second canonical variate approaches significance ($p=.06$). However, the statistical test is conservative since attenuation corrections and stepwise procedures have not been employed. The weighting pattern of the variate is educationally interesting and worthy of comment. The first variate suggested a pattern of climate predictive of roughly equal gains on all three criteria simultaneously; the second implies a climate in which gains in Physics Achievement are incompatible with Science Understanding and positive affect toward being a physics student (Semantic Differential). The pattern reflects an "achievement-creativity" dualism indentified in prior work (Walberg and Anderson, 1968). The climate variables positively associated with gains in understanding and affect suggest what might be termed "centrifugal" forces in the classroom: Friction among the class members, Social Heterogeneity, Goal Diversity, and Disorganization. The positive weight on Formality may mean that official rules and sanctions are imposed in these classes to keep the group together. Today's emphasis on achievement and the authoritarian aspects of the school and the teaching role (Walberg, 1966) may be antithetical to the kind of classroom climate which fosters scientific understanding and interest in the subject.

Conclusion

Previous bivariate research has shown little relationship between such things as supervisor or observer ratings and tabulations of teacher behaviors on the one hand and learning criteria on the other (see reviews by Medley and Mitzel, Remmers, and Withall and Lewis in Gage, 1963). Certainly none of these measures has accounted for much more than ten percent of criterion variance. Despite the unreliabilities of the climate predictors, the sampling inadequacies, and the preliminary nature of this study, we suspect that since students are the primary receivers of psychological influence from their teacher and fellow students, they are more adept at perceiving, judging, and rating those multivariate aspects of the socio-emotional climate of their classes which make for their own learning. Replications of the present research series are now in progress with an improved measure of classroom climate and a national random sample of classrooms. If similar results are obtained, it will be possible to gain considerable insight into the nature of the relationships between student and teacher characteristics that interact to form the socio-emotional properties of the class. Also, it will be possible to explore further the manner in which classroom climate leads to different learning outcomes.

Table 1

Intercorrelations Among Classroom Climate, IQ and Three Measures of Class Learning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.Friction(.66)																	
2.Class Intimacy(.75)	-07																
3.Goal Direction(.41)	-08	28															
4.Social Heterogeneity(.65)	16	-38	02														
5.Goal Diversity(.56)	-04	10	-18	11													
6.Status(.55)	17	11	28	25	32												
7.Subservience(.42)	-04	-07	-13	-08	09	03											
8.Satisfaction(.40)	-13	02	15	12	13	15	-20										
9.Strict Control(.47)	-29	24	25	-18	02	30	18	04									
10.Disorganization(.78)	48	09	-26	02	02	04	-02	-19	-10								
11.Personal Intimacy(.66)	06	53	-09	-22	26	11	02	-03	11	19							
12.Stratification(.69)	31	-03	-45	08	24	27	08	-21	-01	29	24						
13.Egalitarianism(.60)	-24	06	39	07	-20	00	-10	24	23	-26	-19	-42					
14.Formality(.49)	05	11	32	05	-05	34	-11	-06	56	-05	-17	-07	12				
15.Henmon-Nelson IQ(.1.77)	-24	04	00	-44	-17	-23	-01	17	-00	-10	07	-15	05	-21			
16.Science Understanding(1.34,1.39)	30	14	03	02	13	11	-09	-02	11	10	24	-10	-07	12	-04		
17.Physics Achievement(.96,1.09)	-31	14	05	-27	-04	-03	04	22	00	-43	16	-04	21	-31	26	-30	
18.Semantic Differential(.47,.17)	-04	-06	33	05	-10	-06	-21	09	-08	-24	-16	-49	13	06	06	-07	-06

Note: Reliabilities of the Classroom Climate class means are shown in parentheses as is the standard error of the class mean for IQ and the pre and post means of the three criteria. Decimals have been omitted. Read correlations in hundredths.

Table 2

Relationships Between Classroom Climate and Class Learning

	Multiple Correlations			Canonical Correlations	
	Science Understanding	Physics Achievement	Semantic Differential	First Variate	Second Variate
Variance Accounted for	33	46	34	51	45
Correlation	57	68	59	71	67
Probability	34	04	27	04	06
Variables		Beta-Weights			
Friction	54	-10	14	40	38
Class Intimacy	04	05	-11	-01	-08
Goal Direction	-19	-02	14	-05	01
Social Heterogeneity	09	-26	02	-11	30
Goal Diversity	14	-14	05	04	22
Status	05	16	02	16	-13
Subservience	-18	02	-16	-23	-17
Satisfaction	-11	14	-06	-02	-21
Strict Control	37	-05	-03	20	18
Disorganization	-14	-41	-17	-50	27
Personal Intimacy	21	13	04	27	-03
Stratification	-48	17	-50	-56	-59
Egalitarianism	-11	19	-13	-03	-29
Formality	-09	-32	04	-25	30
Science Understanding	100			58	34
Physics Achievement		100		58	-85
Semantic Differential			100	57	40

Note: Decimals have been omitted.
Read in hundredths.

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