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CLASSROOM CLIMATE AND INDIVIDUAL LEARNING.

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TO INVESTIGATE THE RELATIONSHIP BETWEEN INDIVIDUAL SATISFACTION WITH CLASSROOM CLIMATE AND LEARNING, 2100 HIGH SCHOOL JUNIORS AND SENIORS WERE ASKED TO EVALUATE THE HARVARD PROJECT PHYSICS, AN EXPERIMENTAL COURSE WHICH UTILIZED NEW INSTRUCTIONAL METHODS AND MATERIALS. A 50 PERCENT RANDOM SAMPLE FROM EACH CLASSROOM WAS ADMINISTERED THE PHYSICS ACHIEVEMENT TEST, THE SCIENCE PROCESS INVENTORY, THE SEMANTIC DIFFERENTIAL FOR SCIENCE STUDENTS, AND THE PUPIL ACTIVITY INVENTORY (CRITERION MEASURES) AT THE BEGINNING AND END OF THE YEAR, WHILE A RANDOM FOURTH OF EACH CLASS WAS GIVEN THE CLASSROOM CLIMATE QUESTIONNAIRE AT MIDYEAR. IT WAS FOUND THAT--(1) SIGNIFICANT AND COMPLEX RELATIONS EXISTED BETWEEN CLIMATE MEASURES AND LEARNING CRITERIA, I.E., STRATIFICATION AND FRICTION CLIMATE VARIABLES PREDICTED SCIENCE UNDERSTANDING WHILE OTHERS PREDICTED PHYSICS ACHIEVEMENT AND ATTITUDES TOWARDS LABORATORY WORK. (2) GROUPS OF CLIMATE VARIABLES PREDICTED LEARNING BETTER THAN OTHERS, E.G., STRUCTURAL VARIABLES SUCH AS ISOMORPHISM (THE TENDENCY FOR CLASS MEMBERS TO BE TREATED EQUALLY) AND ORGANIZATION WERE BETTER PREDICTORS THAN COACTION (COMPULSIVE RESTRAINT OR COERCION). REPLICATIONS OF THE STUDY (USING A NATIONAL RANDOM SAMPLE) ARE BEING CARRIED OUT WITH REVISED INSTRUMENTS. (AW)

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Classroom Climate and Individual Learning

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Two recent studies have shown that scores obtained on a measure of the socio-emotional climate of the classroom (Walberg, 1966) can be predicted from earlier measures of 1) teacher personality (Walberg, 1968a) and 2) student ability and interest in the subject (Walberg and Anderson, 1968). Yet this work is incomplete in that it does not demonstrate that individual satisfaction with the climate of the class on the part of the student makes for learning, the criterion of institutional effectiveness espoused by school boards, parents, administrators, and teachers. The intent of the present research is to investigate this crucial relationship and to explore empirically further hypotheses derived from a socio-psychological theory of the classroom as a social system (Getzels and Thelen, 1960).

[1]This research is part of the evaluation of Harvard Project Physics, a course development project supported by the Carnegie Corporation of New York, the National Science Foundation, the Sloan Foundation and the U.S. Office of Education. The authors thank Mary Hyde and Arthur Rothman for computer consultation and special programing.

Getzels and Thelen make an analytic distinction between institutional role-expectations and individual personality-dispositions which both bear upon the climate of the class. The constellation of role-expectations can be termed the "structural" dimension (Walberg, 1968b); it refers to the structure or organization of student roles within the class, for example, such things as goal direction and democratic policy. The structural dimension applies to shared, group-sanctioned classroom behavior while the "affective" dimension pertains to idiosyncratic personal dispositions to act in a given way to satisfy individual personality needs. Aspects of the affective dimension are such things as satisfaction, intimacy, and friction in the class. A recent multivariate study of 72 classrooms in the same theoretical vein showed that student perceptions of the structural and affective aspects of socio-emotional climate are strongly related (canonical correlations as high as .8). And although the patterns of correlation are complex, they are interpretable in terms of the Getzels-Thelen conceptual scheme and certain other socio-psychological theories (Walberg, 1968b). The present study fits into the series as follows:

Input September Pretests	Throughput December Midtest	Output May Posttests
Personality and Cognitive Measures on	Classroom Climate	Student Learning
Teachers ⟶	Structure - - - →	Cognitive
	↕	Affective
Students ⟶	Affective - - - →	Behavioral

The solid lines refer to relationships that have already been established in prior work; the broken lines refer to the purpose of this study: the examination of the hypothesis that individual student achievement and interest in the subject at the end of the school year can be predicted from structural and affective aspects of classroom climate measured at midyear.

Our previous studies were of the class as a whole and, hence, the units of analysis were the means of the student measures within each class. It has been shown that the correlation of means of subgroups and the correlation of individuals within the same sample can differ in sign and magnitude (Robinson, 1950). Hence, a parallel means analysis is in progress to complete the series above, but the focus of this study is the individual. It seeks to determine the learning of individuals with different perceptions of classroom climate rather than the mean perception of the entire classes.

Method

Subjects and Instruments

Some 2100 high school juniors and seniors in 76 classes throughout the country participated in the preliminary evaluation of Harvard Project Physics, an experimental course using a variety of new instructional media and emphasizing the philosophical, historical, and humanistic aspects of physics. The mean Henmon-Nelson IQ of a random sample of the group is 115. Their scores on five instruments constitute the data for analysis.

The battery of cognitive, affective, and behavioral criterion measures includes the Physics Achievement Test, the Science Process Inventory, the Semantic Differential for Science Students, and the Pupil Activity Inventory. The Physics Achievement Test (Ahlgren, Walberg, and Welch, 1966) is a 36-item multiple-choice test designed to measure general knowledge of physics. It has a Kuder-Richardson Formula 20 reliability (Guilford, 1954) of .76 based on a random sample of 400 high school students at the end of their physics course. The Science Process Inventory (Welch, 1966) consists of 100 true-false statements describing the assumptions, activities, products, and ethics of science. The test was validated on a sample of eminent scientists and has a KR 20 reliability of .86.

The Semantic Differential for Science Students (Ahlgren, Geis, Walberg, and Welch, 1966) is familiar to many researchers and has been described elsewhere (Osgood, Suci, and Tannenbaum, 1957; Walberg and Anderson, 1968). Six scales reflecting affective objectives of Harvard Project Physics were selected for analysis. Using the Spearman-Brown formula to correct the mean item inter-correlations for the number of items (Guilford, 1954) yields reliabilities of about .8. (See Table 1 for reliabilities of all scales and tests discussed here.)

The Pupil Activity Inventory was described by Cooley and Reed (1961). It consists of a number of adolescent science activities, and the student is asked to indicate the frequency of his participation in each. Walberg (1967) re-factor analyzed the instrument for the present sample and found five dimensions: Academic, Biological, Tinkering, Cosmology, and Applied Life. The Academic, Tinkering, and Cosmology cluster scores were summed for a Physical Science Activity score which yields an S-B corrected internal consistency of .76.

The first form of the Classroom Climate Questionnaire (Walberg, 1966) consists of 80 items describing characteristics of school classes, for example, "The class members are working toward many different goals." The respondant expresses agreement or disagreement with each on a four-point scale. The instrument yields 18 factor analytically-derived cluster scores which, for individuals, range in corrected split-half reliability from .41 to .86 (See Table 1 and Walberg and Anderson, 1968). A revised instrument with more items and hopefully greater reliability is being used to replicate our work this year.

Procedure

The data were obtained using a randomized data collection system within each class which tends to minimize individual testing time but maximize the number of tests which can be administered (Walberg and Welch, 1968). The system is most appropriate for class means analysis but does provide patterns of scores for studies of individual students as well, with certain restrictions. Random halves of the students took the criterion measures at the beginning and at the end of the year; a random fourth took the Classroom Climate Questionnaire at midyear. The sampling fraction for any combination of tests is the product of the sampling fractions for the combination. Thus for the midtest and any posttest, a fourth times a half or an eighth took both measures. To bring pretests into the analysis, the eighth must be multiplied by a half giving one-sixteenth. Thus for a total of 1700 students who finished the course, about 214 have taken the midtest and a given posttest, and 106 have taken the same pretest and posttest as well as midtest. Actually because of absentees and unusable answer sheets, the figure is about 85 for any given combination of pre-, mid-, and posttest.

From the group of 25 subscores on the tests given at the beginning and at the end of the course, nine were selected as criteria for measuring student learning since they measure cognitive, affective, and behavioral course objectives. They are: Physics Achievement, Science Understanding, six Semantic Differential measures, and Physics Activities which is the sum of the Academic Science, Cosmology, and Tinkering scales on the Pupil Activity Inventory. The reliabilities of the scales are shown in Table 1. Using a method described by Ferguson (1959), regression-adjusted gain or "delta" scores (the posttests' standardized deviations from predicted scores based on the pretest) were calculated for each of the criteria. These scores represent the student's learning on each criterion during the course adjusted for initial status. The adjusted criteria were correlated with each of the 18 measures of classroom climate.

Results

Table 1 contains 32 statistically significant correlations ($p < .05$) between measured perceptions of classroom climate and the adjusted learning variables. This amounts to four times the chance expectancy in a 9 by 18 matrix of 162 elements.[2] The estimates of association are conservative since the

[2] Stepwise multiple correlations were also calculated with significant results accounting for up to 40 percent of the uncorrected variance in the learning criteria with three predictors. However, because of the small number of cases, the uncertainty of the stepwise procedure without cross-validation, and great number of beta weights, the results are not reported here.

criterion test scores are not highly reliable, and adjusted gain scores are even less reliable. Using the conservative attenuation correction for unreliability of the criterion test only, the correlations rise from 7 to 28 percent. The correlations rise from 16 to 200 percent when corrected for criterion and predictor unreliability. Since the question of reliability of gain scores is still unsettled (See Harris, 1963), this further correction for a third source of error variance is not considered here. In any case, uncorrected correlations and scale reliabilities are shown in Table 1. The interested reader is referred to Guilford (1954) for attenuation correction formulas.

Discussion

While the study is exploratory and employs a preliminary form of the instrument, the results are statistically significant and meaningful enough to warrant interpretation. One way to do this is to characterize the perception of classroom climate for students who made greatest gains on the different criteria by examining the columns of correlations in Table 1. Students who gained the most on the physics achievement test, for example, perceived their classes as socially homogeneous, intimate groups working on one goal; one might speculate that the goal is high achievement on physics tests.

On the other hand, students who grew more in science understanding saw their classes as well organized with little friction between their fellow students, and although the class is seen as egalitarian and unstratified, the students had a greater variety of interests. Thus different perceptions of classroom climates are associated with different kinds of cognitive growth--achievement and science understanding.

Perceptions of climate also predict the affective growth the course is intended to bring about. We shall examine the correlates of only one of the two ratings for each of the three concepts reported in Table 1. Students who reported greater enjoyment of laboratory work perceived their classes as unstratified, democratic in policy setting, having a clear idea of class goals, and satisfying. Students who gained the most interest in physics saw their classes as well organized and unstratified. Those who rated the concept Universe more friendly saw their classes as having clear goals, democratic policy setting, egalitarian, unstratified, and less internal friction and speech constraint. Lastly, students who reported engaging in more physical science activities because they were interested, felt more personally intimate with their fellow class members, less alienated and less strictly controlled.

Thus students with various perceptions of classroom climate grow in different ways during a course. Another way of examining the results is to analyze the correlations across the rows to determine which climate variables correlate most often with student learning variables. The structural climate variables can be divided into three subgroups: those having to do with "coaction," "isomorphism," and "organization."[3] An enormous amount of research has investigated "teacher- vs. "student-centered" classrooms or other variations on the themes of "authoritarian" and "dominant" teaching methods (Gage, 1963). However, most of the studies, whether they employ tabulations of systematic observations or observer ratings, fail to significantly account for variance in student learning. Three "coaction" climate variables, Subservient, Strict Control, and Speech Constraint, seem to be related to this dimension, and among the three, there is only one correlation with student learning.

On the other hand, a more promising dimension for predicting learning is "isomorphism" or the perceived equality of class members. Democratic, Stratified, and Egalitarian correlate significantly with learning in eleven instances. Stratification correlates with six learning measures, more

[3]These terms are used as a matter of convenience in discussing the results. Except in the case of "syntality," a term employed for some years by Cattell (See Bereiter, 1966), we shall refrain from using or adding new terms to the copious jargon of psychology. In all other cases, we have used words with dictionary definitions which are to be understood as operationally defined and discussed here.

than any other variable. Perhaps like penal or military institutions, learning can be at least partially satisfying and effective in dominated, oppressed groups as long as everyone is treated equally. It may be that when one inmate, rookie, or student is unfairly favored or set above the other, the energies of the group are diverted from the attainment of institutional or private goals into the resulting dissention.

Another group of structural measures that predict learning have to ho with "organization" of the class--Goal Direction, Disorganization, and Formality. This group calls to mind Ryans' (1960) "Teacher Characteristics Pattern Y"--responsible, businesslike, systematic teacher behavior. A previous study (Walberg, in press) showed that these climate variables can be predicted from teacher personality. Among the organization measures, there are eight correlations with learning criteria.

Let us now turn to the affective climate predictors which can be grouped into "syntality" and "synergism" measures. One might derive from political theory the hypothesis that, like nationalism which promoted modern states, "syntality" or emotional identification with a group cause enhances learning. Such does not appear to be true of the class, however; with one exception, the "syntality" measures, Group Status, Classroom Intimacy, and Alienation, do not predict the criteria. Waller's hypothesis (1932) that students identify with the school through competitive <u>extramural</u> sports, pep rallies, social clubs, and the like may prove more fruitful empirically.

The climate measures of "synergism," the personal (or what some psychologists have termed the "psychodynamic" or "inter-personal") relations between class members do predict learning. These variables are Personal Intimacy, Friction, and Satisfaction, and they account for 12 correlations with the criteria. Thus it is not the identification with the group that correlates with learning but the perception that the class is personally gratifying and without hostilities between the members.

Summary and Conclusions

This is one of a series of exploratory studies derived from a socio-psychological theory of the classroom as a social system (Getzels and Thelen, 1960). In a national non-random sample of 76 high school physics classes, it tests the hypothesis that individual perceptions of 18 structural and affective aspects of classroom climate predict 9 cognitive, affective, and behavioral learning measures adjusted for initial differences. Simple and multiple correlation revealed significant and complex relations between climate measures and learning criteria. For example, Stratification and Friction predicted science understanding, but other climate variables predicted physics achievement and attitudes toward laboratory work.

In addition, groups of climate variables predicted learning better than others. Among the structural variables, "isomorphism" (the tendency for class members to be treated equally; see Discussion for further explanation) and "organization" (efficient direction of activity) predicted learning much better than "coaction" (compulsive restraint or coercion). Among the affective climate measures, "synergism" (personal relations among class members) predicted learning better than "syntality" (identification with group goals).

Replications of the entire series of studies are being carried with revised and, hopefully, more reliable instruments using a national random sample. Should the results hold up in other samples especially in other school subjects, they should increase our understanding of the social psychology of the class. Moreover, from a practical point of view, the ability to predict learning outcomes from assessments of classroom climate may have implications for teacher education, behavior modification of in-service teachers, and the assessment of teaching effectiveness provided educators can agree on measurable goals of education.

Table 1
Correlations of Classroom Climate and Student Learning Measures

Classroom Climate	Cognitive		Affective						Behavioral
	Physics Achievement	Science Understanding	Laboratory		Universe		Physics		Physics Activities
			Important	Fun	Beautiful	Friendly	Interesting	Important	
	(76)	(86)	(85)	(71)	(65)	(61)	(81)	(69)	(70)
Structural Aspects									
Coaction									
Subservient (57)									
Strict Control (51)									-21
Speech Constraint (41)						-25*			
Isomorphism									
Democratic (80)			26*	28*	22*	18			
Stratified (55)		-22*	-34*	-22*	-25*	-24*	-27*		
Egalitarian (67)		20			32*	40*			
Organization									
Goal Direction (80)			41*	25*		26*		24*	
Disorganized (55)		-21					-30*		
Formality (51)			23*		23*				
Goal Diversity (64)	-19*								
Affective Aspects									
Syntality									
Classroom Intimacy (79)									
Alienation (75)									-20
Group Status (68)									
Synergism									
Satisfaction (53)			30*	24*	18			20	
Friction (86)		-31*	-24*		-23*	-27*		-23*	
Personal Intimacy (58)	20*		20						26*
Social Heterogeneity (79)	-23*				-27*				
Interest Heterogeneity (51)		21	-23*					-19	

Decimals and correlations below the .10 significance level are omitted. Correlations significant at the .05 level are indicated with an asterisk. The sample sizes are as follows: Physics Achievement, n=96; Science Understanding, n=76; affective measures, n=82; Physics Activities, n=82.

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