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AUTHOR	O'Reilly, Robert
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ABSTRACT

This study shows that the psychosocial climate of a classroom has an effect on the learning of students. Consequently, teachers and supervisors should monitor the classroom climate and develop techniques for improving it. The subjects for the study were 1,100 secondary students in 48 mathematics classes in eastern Ontario. Variables in the study included pupil scholastic aptitude, student achievement, classroom climate as measured by the Learning Environment Inventory, and pupil characteristics such as social background, liking for school, and future orientation. (Author)

CLASSROOM CLIMATE AND ACHIEVEMENT IN SECONDARY SCHOOL MATHEMATICS CLASSES

ROBERT O'REILLY

UNIVERSITY OF OTTAWA

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The purpose of this paper is to examine classroom climate as an intervening, or process, variable in education. Administrators and supervisors examine pupil achievement when they assess educational programs. In their evaluation they also allow for the native ability and social background of students. Yet, although they claim to pay a great deal of attention to actual classroom behavior, they fail to examine in a systematic fashion, the psycho-social environment of the classroom as a significant intervening variable. It is proposed here that climate is an important variable which should be monitored, manipulated and related to educational outcomes. In order to demonstrate this, data collected in an Ontario study will be utilized to examine the relationships between certain social and personal characteristics of pupils, the climate of grade 9 and 10 mathematics classes, and mathematics achievement of students.[1]

Background.

The most persistent questions faced by the educational researcher are those which ask "What accounts for the variation in the learning of pupils achieved in the classroom?" Thus far, we have been quite successful in relating achievement to student aptitude and to such home factors as socio-economic status, expectations for success and level of parents' education. Pupil aptitude and scores on I.Q. tests usually account for about 50 per cent in the variance in school achievement

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1 Robert O'Reilly and Parnell Garland, Paradigm For Evaluation in the High School, Ottawa, University of Ottawa, 1974. This study was partially supported by a Grant-in-Aid to Educational Research by the Ontario Ministry of Education. Additional support was received from the Faculty of Education, University of Ottawa.

whereas home factors account for 65 per cent of the variance in standardized tests. It is on the basis of results such as these that social reformers state that schools do little to reduce effects of social inequalities. Jencks does suggest in his conclusions[2], that it is the social environment that immerses the school and the child which accounts for learning rather than curricula, teaching style or the availability of resources. He recommends that schooling be thought of as an end in itself rather than as a means to other ends such as cognitive development or as preparation for adult responsibilities. He goes on to say that although schools should have goals, for all enjoyable activities require purpose, looking back over his data, he concludes that it doesn't matter what those goals are.

Educators must study carefully the reports of studies such as Jencks; however, to accept his conclusions and the model of schooling implied in those conclusions would be to deny our profession as educators. Education is predicated on the premise that, as a result of performing given activities, pupils will change and the change will be in given direction. That is, schools aid children to develop in desired and desirable directions.

We do not deny the existence of heredity. But it is our point of departure; not our end-point.

We agree that the social context of learning is also important; but we deny that the macro-social environment is so overwhelming that

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2 C. Jencks et al., Inequality: A Reassessment of the Effect of Family and Schooling in America, New York, Basic Books, 1972 pp. 255-257.

the micro-onvironment of the school and of the classroom is insignificant for learning.

Modern behavioral science, since the time of Kurt Lewin, has been constructed on the dual premise that the social-psychological environment or climate of a work group strongly influences outcomes, and that this climate is influenced by the group leadership and is thus subject to manipulation.[3]

Although a number of methodologies have been devised to research these variables in schools, few studies have been designed to relate climate to learning outcomes. A recent survey located only 13 such studies[4] in addition to a series to be discussed below. The thirteen studies indicated few clear-cut relationships between climate and achievement. The authors attribute this, among other reasons, to the poor validity of instruments, and the use of global concepts of climate rather than breaking it down into its components.[5]

In another survey of the research, Rosenshine encountered similar difficulties.[6]

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3 Kurt Lewin, "Frontiers in Group Dynamics" Human Relations, I:1, (1947), pp. 5-41.

4 H.D. Nielsen and D.H. Kirk, "Classroom Climates" in H.J. Walberg (ed.), Evaluating Educational Performance, Berkeley, California, McCutchan Publishing, 1974, pp. 57-79.

5 Ibid., p. 74.

6 Barak Rosenshine, "Evaluation of Instruction", Review of Educational Research, XL:2 (April, 1970), p. 293.

One classroom climate rating form which has enjoyed some success is the Learning Environment Inventory, (LEI) developed by Walberg and Anderson for the evaluation of the Harvard Project Physics.[7] This instrument has been useful in relating climate to achievement; it has also been useful in that teaching methods also related to climate as measured by the LEI.

The final version of the scale contains 105 statements describing typical school classes. Each student expresses his agreement or disagreement on a four point scale. The items are grouped into 15 scales as defined in Table I.

Several reliabilities are available. For class groups, intraclass correlations range from .31 to .92 for each scale. Test re-test correlations for each scale range from .43 to .73. The LEI was successfully utilized in a variety of experimental and correlational studies, described by Anderson and Walberg.[8]

Design of the Study.

The unit of analysis in this study is the classroom, and all scores are average classroom scores. Forty-eight classrooms from 12 secondary schools from four boards of education in Eastern Ontario constituted the sample. To fulfill certain requirements of the major project, a combination of random and judgmental sampling was employed.

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7 H.J. Walberg and Gary Anderson, "Classroom Climate and Individual Learning", Journal of Educational Psychology, LIX (1968), pp. 414-19.

8 Gary Anderson and Herbert J. Walberg, "Learning Environments", in Herbert J. Walberg, (ed.), op. cit., pp. 81-98.

TABLE I

LEARNING ENVIRONMENT INVENTORY SCALES

1. Cohesiveness: The feeling of intimacy that has developed as a result of several individuals interacting over a period of time.

2. Diversity: The extent to which the class provides for a diversity of pupil interests and activities.

3. Formality: The extent to which behavior within the class is guided by formal rules.

4. Speed: The rate of progress of the class.

5. Environment: The physical environment, including the amount of space available and the type of recreational equipment.

6. Friction: The extent to which conflict may affect the behavior of the class.

7. Goal Direction: The recognition of goals and their subsequent acceptance by the group.

8. Favouritism: The extent to which pupils possess a low academic self-concept.

9. Cliqueness: Aims at revealing the extent to which cliqueness exists in a classroom and its influences on social interaction.

10. Satisfaction: The extent to which students like or dislike their class.

11. Disorganization: The extent to which students consider their class to be disorganized.

12. Difficulty: The relative perceived difficulty levels of various courses.

13. Apathy: Complements the cohesiveness scale, but also indicates if individuals within the class feel any affinity with class activities.

14. Democratic: Indicates the extent to which a "democratic" atmosphere exists within a classroom.

15. Competitiveness: The degree of competitiveness existing within the class.

The forty-eight classes were equally divided between the grades 9 and 10 levels (or equivalents) and between advanced academically-oriented and general or terminal classes. A total of 1100 students participated.

Data Collection.

Data were collected from students with the following instruments:

1. Stanford Achievement Test (SAT): Mathematics Form W.
2. Biographical data.
   a) parents education.
   b) dislike for school.
   c) future planning.
3. LEI.
4. School and College Ability (SCAT) Test, Series II.

Questionnaires and tests were administered in two sittings with each of the 48 classes. One sitting involved the administration of the Stanford Achievement Test-Mathematics - Part A, and the SCAT-Series II, Form 2A in Grade 10 Classes, Form 3A in Grade 9 Classes. The Stanford was administered to 2/3 of the class while the SCAT was administered to the remaining one third. In the other sitting, the LEI and the Biographical Inventory were administered to one half of the class while other tests were administered to the remainder of the class. Males and females were proportionally represented in each segment of data collection.

The order of administering sets of instruments in the two settings was alternated to eliminate order effects. This method of collecting data was consistent with procedures used by Anderson and was economical in terms of research effort.

TABLE II

MATRIX OF INPUT AND OUTPUT VARIABLES

VARIABLE	2	3	4	5	R
1. ACHIEVEMENT	.83	.48	-.41	-.26	.88
2. SCHOLASTIC APTITUDE	1.00	.45	-.33	-.26	
3. PARENTS' EDUCATION		1.00	-.08	-.30	
4. DISLIKE FOR SCHOOLING			1.00	.23	
5. CAREER PLANNING				1.00	

N = 48 $r_{.05} = .30$

Analysis of Data.

In order to analyse the results obtained in this project, the framework of INPUT-PROCESS-OUTPUT will be used.

Input variables. Input variables are usually beyond the control of the educator. These givens are: 1. scholastic aptitude (I.Q.); and 2. biographical indices. Correlations with Achievement are shown in Table II.

Scholastic aptitude is related to achievement (verbal, r=.62; mathematical, r=.86).

Of the biographical indices, parents' education is related to achievement (r=.48); dislike for schooling is similarly related (r = .41). The third biographical variable, labeled "career planning" was intended to obtain an index of the student's future orientation, but it proved to be unsatisfactory in this study.

Taken altogether, these input variables account for 77% of the variance in achievement (R = .88).

Process Variables. The process variables are the fifteen scales of the LEI. Taken together, they account for 67 per cent of the variance in achievement (R = .82) (Table III)

The LEI variables are not independent of input variables. This one might expect, as pupils bring their a great deal of their world into the classroom. Pupils have a significant effect on the climate of the classroom.

Eleven of the 15 LEI variables are associated with input variables (variables 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15). The scholastic aptitude is associated with nine LEI scales. All input variables are

TABLE III

CORRELATIONS OF INPUT-PROCESS AND OUTPUT VARIABLES

LEI SCALES	IQ	BI(1)	BI(2)	BI(3)	ACHIEVEMENT
1. COHESIVENESS					30
2. DIVERSITY					
3. FORMALITY					
4. SPEED					
5. ENVIRONMENT			-46		32
6. FRICTION	-54	-31	45	35	-59
7. GOAL DIRECTION		30			
8. FAVOURITISM	-42		45		-44
9. CLIQUENESS	-33				-34
10. SATISFACTION	43	31	-49	-39	45
11. DISORGANIZATION	-50	-35	48	48	-52
12. DIFFICULTY	40	31			33
13. APATHY	-52	-40	42		-44
14. DEMOCRATIC	33		-41		47
15. COMPETITIVENESS	35				
R					82

IQ is SCAT-TOTAL, BI(1) is PARENTS' EDUCATION, BI(2) is DISLIKE FOR SCHOOLING, BI(3) is CAREER PLANS. ONLY SIGNIFICANT CORRELATIONS ARE SHOWN. DECIMALS ARE OMITTED.

N = 48

related to variables Friction, Satisfaction and Disorganization. In addition, "Dislike for schooling" is related to Favoritism, Apathy and Democratic variables. "Parents' education" is related to an additional three variables: Goal Direction, Difficulty and Apathy.

Ten LEI variables are related to achievement. Achievement in mathematics classes is characterized by high scores on the following variables: Cohesiveness (.30); Environment (.32); Satisfaction (.45); Difficulty (.33); and Democratic (.47). High achieving classes are noted by low scores on Friction (-.59); Favoritism (-.44); Cliqueness (-.34); Disorganization (-.52); and Apathy (-.44).

Discussion.

There are a number of concerns here for the administrator. If Input is related to both PROCESS and ACHIEVEMENT, can the teacher be in any way held accountable for the classroom climate or for the achievement of pupils?

In order to answer that question, three elements must be considered. First, do input variables account for all the variance? Second, can teachers modify the environment of the classroom? Third, can school be a fruitful experience for all pupils?

One technique available to answer the first question is to compute partial correlations, a technique which first subtracts the common variance which two variables share with a third variable. Walberg and Anderson computed correlations between LEI variables and year-end provincial examination scores covering eight subject areas

TABLE IV

Correlations Between Learning Environment Scales and Mathematics Achievement Scores (SAT) and Partial Correlations

Environment Scales	Mathematics Achievement	Partial Correlations, Controlling for... Intelligence SCAT-Total	Parent's Education	Dislike for Schooling	Future Plan Orientation
1. Cohesiveness	.30		.29	.25	.30
2. Diversity		-.35			-.26
3. Formality					
4. Speed					
5. Environment	.32		.32		.28
6. Friction	-.59	-.30	-.53	-.49	-.55
7. Goal Direction					
8. Favoritism	-.44		-.38	-.32	-.41
9. Cliqueness	-.34		-.27		-.32
10. Satisfaction			.36	.31	.39
11. Disorganization	-.52		-.43	-.40	-.47
12. Difficulty	.33			.40	.31
13. Apathy	-.44		-.31	-.32	-.41
14. Democratic	.47	.36	.41	.36	.43
15. Competitiveness	.25			.31	
R	.82				

$r_{.05} = .29$ Blanks indicate $r < .25$.

N = 48

with intelligence partialed out of the relationship. His sample was 64 grade 10 and 11 classes from eight schools in Montreal. Twelve of the LEI scales were significantly related to over-all achievement.[9] The size of the correlations, on the average, were 10% smaller than the correlations between achievement and LEI scales. The data from the O'Reilly and Garland study[10] is less satisfying (Table IV). Correlations between achievement and LEI scales with total SCAT scores partialled out yielded only three significant correlations (Diversity, -.35; Friction, -.30; Democratic .36). In this case, the Walberg and Anderson data should be given greater credence, since they related their scores to actual examination results, whereas the O'Reilly and Garland study utilized standardized achievement tests which are somewhat confounded with scholastic aptitude tests. The correlation between achievement and aptitude in the O'Reilly and Garland study was .82 and in the Walberg and Anderson study it was only .38.

In considering correlations between achievement and aptitude when biographical indices are partialled out, the effects of the LEI scales remain pronounced. When controlling for parents' education, seven of the ten LEI scales remained significantly correlated. Overall the correlations are approximately 10% lower.

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9 Herbert Walberg and Gary Anderson, "Properties of the Achieving Urban Classes", Journal of Educational Psychology, LXIII:4 (1972), pp. 381-5.

10 Op. cit.

When controlling for the pupils' dislike for schooling, eight correlations remain significant.

Controlling for future plan orientation produces almost no changes.

Thus, although students' characteristics do predict class environment to some extent, there is still room for the effect of teacher and school controlled variables upon academic achievement.

The answer to the second question cannot be answered by the data presented here, but there is the inference that teachers can influence climate and consequently achievement. Further, it is axiomatic in the literature on leadership, supervision and management, that leaders do have an impact on both group climate factors and on achievement.[11] Early studies by H.H. Anderson and Brewer established that a teacher can have an effect on classroom climate very early in the school year.[12] It would seem logical to assume that the climate of a classroom is the result of the interaction of pupil and teacher characteristics and that the influence of the teacher would not be insignificant. Consequently a study of classroom climate early in the school year would be advisable.

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11 See for example R. Likert, The Human Organization, Toronto, McGraw-Hill, 1967.

12 H.H. Anderson and J.E. Brewer, "Studies of Teacher Classroom Personalities," Applied Psychology Monograph, 1945, No. 6.

To the third question, "can the school be a fruitful experience for all students?" the reply must hinge on the level of ability of the teacher. In an age when teachers were less well trained and when they were few opportunities for professional development, it could have been expected that teachers would easily teach the able and motivated student, whereas the others, subjected to repeated failure, would eventually drop out. Today it is difficult to excuse a university trained profession with ample opportunities for professional development, for failure to provide the majority of all pupils with satisfying learning experiences within the school.[13]

The identification of important aspects of climate gives an added tool to teachers and supervisors. In management theory, it has been shown that trends in the change of direction in climate can be detected fairly early, whereas the effects of such changes on productivity might be delayed by as much as two years.[14] Educators could begin to systematically monitor classroom climate and attempt to influence its nature. Expertise to do this is rapidly appearing in the education profession.[15] A supervisory program could be designed which would call for early monitoring of classroom climates, and if the situation warrants it, expert assistance, perhaps in the form of a school guidance teacher or an organizational development professional, would assist in a program of climate change.

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13 This is not intented as an indictment of teachers, but is is a comment on the entire structure of education, including its governance, administration, and training programs for teachers.

14 R. Likert, op. cit.

15 Phi Delta Kappa, School Climate Improvement, Bloomington, Indiana, the Association, 1974.

To return to the discussion of the study by Jencks, on the basis of the material presented in this paper, we can conclude:

1. Classroom climate is a significant factor in pupil achievement.

2. Although pupil personal and social characteristics are important correlates of achievement, climate in some instances is a more important factor.

3. Although input, process and output are all inter-correlated, process variables have an independent effect on achievement.

4. Education includes psycho-social factors as well as academic factors and the two are related.

This paper has presented data from 1100 students which suggests that the LEI is a valid, reliable and useful instrument to study classroom climates. Not only is the total scale useful, but its fifteen scales provide a high degree of precision to define productive climates. A discussion of the importance of climate as an intervening variable in educational administration was also presented.

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