DOCUMENT RESUME

ED 152 760 SP 012 556

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TITLE Predicting Success in Innovation.
INSTITUTION Oregon Univ., Eugene. Center for Educational Policy and Management.
PUB DATE Mar 78
NOTE 37p.

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS Decision Making; Elementary Education; *Instructional Innovation; *Predictor Variables; *Staff Utilization; Success Factors; *Team Teaching; *Teamwork
IDENTIFIERS *Unit Organization

ABSTRACT

This document presents results of a prediction investigation into factors that might account for variations in the success of attempts at educational innovation. Four stages of innovation (adoption, planning, implementation, and institutionalization) are isolated and described, and the attention paid by this investigation to the innovation studies (unit organization) is detailed. Unit organization is defined as the arrangement of an (elementary) school faculty into small, permanent, work groups, each with exclusive membership and exclusive instructional responsibility for a large number of children. The outcome variables considered as central elements of the team teaching situation resulting from unit organization are identified as instructional interdependence and collegial decision making. Various through-time changes and other potential predictors of these variables are discussed. The relationships of fixed and planning strategy variables and of implementation strategy variables to performance on these two outcome variables are described. Using preunitization characteristics of the subject schools, prediction was found possible for both variables through the end of the first year, but not beyond. Strategies of planning for the innovation also showed the same predictive ability. In schools where the innovation was first expressed through gains in instructional interdependence in reading and language arts, and where interdependence appeared to be more a school-wide unit-level phenomenon rather than an isolated teacher-pair phenomenon, the innovation thrived over the long term. (MJB)

PREDICTING SUCCESS IN INNOVATION

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and
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MITT PROJECT

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1978

Prepared for presentation at the Annual Meeting of the American Educational Research Association, March 27-31, 1978, Toronto, Canada. The research reported herein was supported in part by funds from the National Institute of Education, U.S. Department of Health, Education and Welfare. Opinions expressed in this report do not necessarily represent the policies or positions of the National Institute of Education, nor should any official endorsement of the report be inferred from supporting agencies.

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PREDICTING SUCCESS IN INNOVATION

John S. Packard and Thomas D. Jovick

Introduction

The major goal of the project, Management Implications of Team Teaching (MITT) was to replicate similar research based claims. The team or unit organizational structure was shown to affect patterns of elementary teacher interaction, their attitudes about work, and the microgovernance of the elementary school. These findings were based on post-treatment designs with control groups (Meyer and Cohen, 1971; Pellegrin, 1970a and 1970b). Among the limits to valid inference, perhaps, the most crucial was the inability to ascertain direction of effect among variables. To overcome this disadvantage, Project MITT recruited a sample of schools of which only half were to install the treatment, unit organization. Measurements were completed in both experimental and control schools before the unit organization had been set up in the experimental schools and four more times at six-month intervals thereafter.

The longitudinal nature of this prime study also afforded the ability to scrutinize the innovation process. We saw two avenues for capturing the dynamics of innovation. One was to study innovation over two years as an unfolding process comprised of distinct, but possibly interrelated, stages. The other was to predict success in innovation on the basis of information taken from the schools before they actually established their unit organization. We refer to these efforts as the companion study.

Although the longitudinal research design gave rise to these opportunities, it also set restrictions on the sort of investigation of innovation we

could pursue. For example, the number of cases was adequate for the analysis in the prime study but was quite small for the companion investigation. Only half the sample--the experimental schools--qualified for examination.* Also, only one sort of innovation was at stake. It was attempted only by elementary schools and only at the same time. Finally, by virtue of the sampling strategy, we could not build into the companion study known variation in any of the presumedly key predictor variables.

Later, we concluded that extant theoretical formulations were not sufficient for predicting differential success in installing this particular innovation. Consequently, the analysis became more an exploratory than a hypothesis-testing venture.

Our efforts to find factors that might account for variations in innovation success were woven around two schemes suggested by Charters and Jones (1974) and variously implicated in the literature on innovation. The first of these we call stages of installation. The second refers to three domains of variables within the implementation process.

Stages of Innovation

Perhaps one of the major intellectual advances in the study of educational reform has been to recognize that planned change is not a simple event. Innovation is a lengthy process consisting of discrete, time-ordered stages (Charters, and Jones, 1974). In order of occurrence, these are

*Fifteen schools qualified for inclusion in the companion study. In most analyses in the report N = 15. Occasionally due to missing data or for purposes of illustration the number of cases is somewhat smaller.

Adoption, Planning, Implementation and Institutionalization. Adoption refers to the initial institutional commitment to reform and the selection of a particular innovation for installation. Planning refers to the period of preparation for the innovation when installation plans are laid, when potential users may receive training, and when there may be contact with consultants in workshops or other special meetings.

Implementation refers to the period in which a school makes initial efforts to enact the details of the innovation in daily work routines. This is viewed as a highly variable period in which the users, with varying degrees of clarity and enthusiasm, attempt to operate the innovation. Institutionalization is the final stage so far identified. It refers to the time in which schools incorporate some degree of innovation in a relatively permanent way. Degree of institutionalization may vary from relatively full expression of the innovation to a return to the pre-implementation status on the criterion variables.

Our first measures were administered in the Planning stage, the spring of 1974, after adoption but prior to the initial implementation of the innovation. The next two measures were spaced at six-month intervals during the 1974-75 school year, a period which we regard as the Implementation stage. The final two measures were taken in the fall and spring of the next school year, during the Institutionalization stage.

For convenience in data presentation, we represent the five waves of data by ordered symbols. T_1 refers to the pretreatment measure, T_2 and T_3 were taken during the Implementation Stage, T_4 and T_5 during the Institutionalization stage. These symbols are used throughout the report.

The manner in which schools were identified as potential experimental sites--following their explicit adoption of the innovation--of course, limited our ability to ascertain the links between the first and the three subsequent stages of innovation. Thus, our analysis omits the effects of the Adoption stage on the following stages.

Fundamental to our investigation has been the recognition of three different sets of variables implicated in the innovation process. We call these Outcome variables, Fixed variables, and Strategic variables. This report examines each type and gives attention to their empirical and theoretical roles.

Outcome Variables

Outcome variables refer to the criterion measures of innovative activity. Unit organization--arranging an elementary school faculty into small, permanent work groups, each with exclusive membership and each with exclusive instructional responsibility for a large number of children--is the "treatment" of interest. Earlier reports had suggested that when so organized, teachers became more task interdependent in their teaching activities and that teaching teams became small centers of teacher group decision-making. These two variables, which we call Instructional Interdependence and Collegial Decision-making, have generally been considered to be the central elements of team teaching. They are the outcome variables of interest in this companion study.

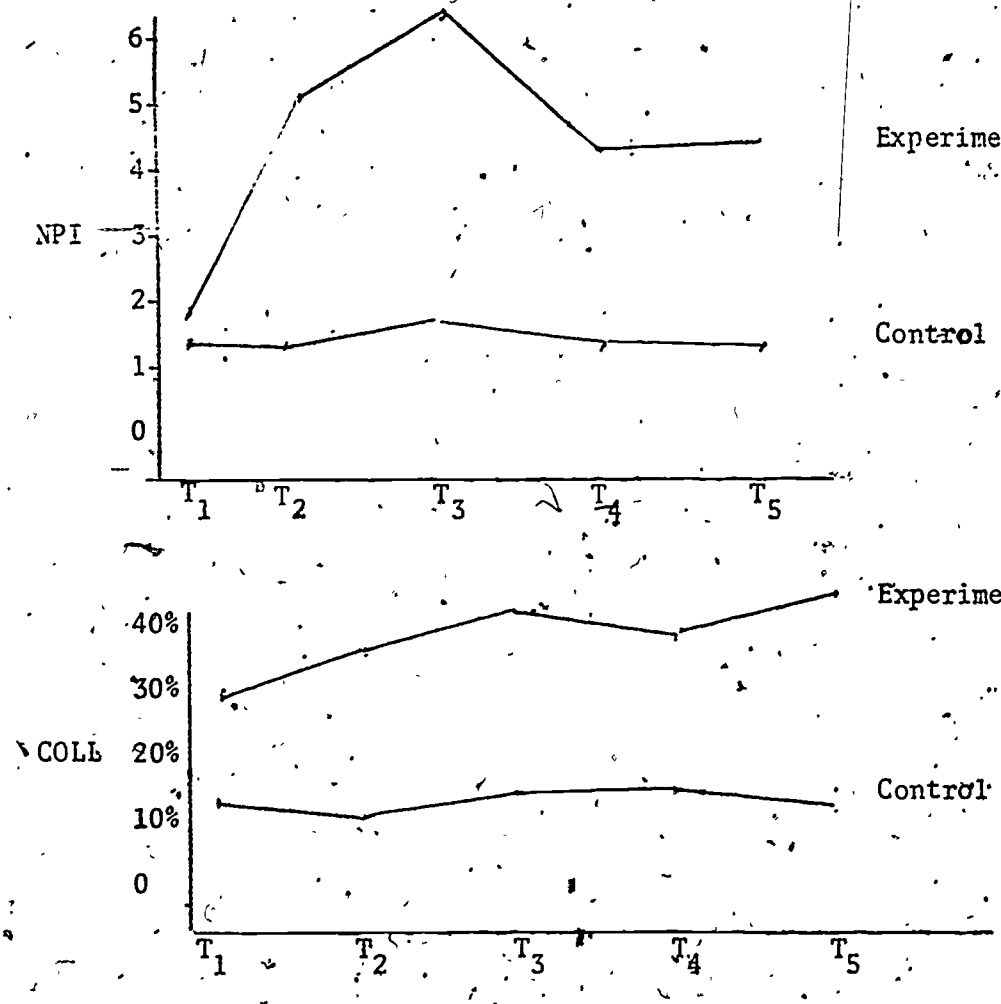
An incident of instructional interdependence occurs when a pair of teachers teach a common set of students in the same subject at or about the same time. Instructional interdependence bonds were identified from logs on which teachers had indicated which individual students they taught in which subjects on which days. We assumed that following the establishment of units we would observe in each experimental school an increase in the number of teacher pairs (bonds) in instructional interdependence (NPI). We assumed also that schools would differ on this number through time.

Collegial decision-making occurs when a group of teachers decides on a course of action that implicates only its members. This and other patterns of school decision-making were counted by employing a rather rigorous and exhaustive interview. In this, knowledgeable respondents were asked who made and who was governed by a large number of specific decisions, which had actually occurred in each school in question. We expected that the proportion of collegial decisions (COLL) would increase following the installation of the unit organization. We also suspected that the proportion of collegial decisions would vary from school to school and within a school over time.

Figure 1 depicts the experimental-school means for each of these variables through time. We contrast them with the control-school means to illustrate that the installation of the unit organization immediately prior to T_2 indeed had its intended effect on Collegial Decision-Making and Instructional Interdependence in the experimental schools. In general, the experimental schools showed a marked initial increase on both variables in the first year

FIGURE 1:

MEAN SCORES FOR EXPERIMENTAL AND CONTROL SCHOOLS; NUMBER OF TEACHER PAIRS IN INSTRUCTIONAL INTERDEPENDENCE (NPI), PERCENT OF DECISIONS MADE COLLEGIALLY



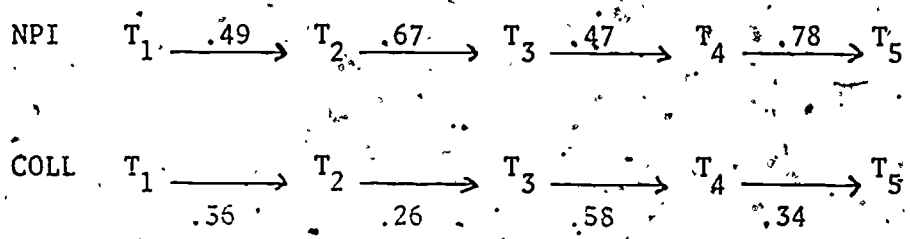
and a drop in the second year for NPI to a level which remained above pre-unitization level. The control schools stayed at a low level on both variables throughout.

The major goal of the companion study was to account for joint variations in the performance of the experimental schools on those two outcome variables. On the one hand we sought to understand better the relationship between the two variables. On the other hand, we hoped to account for the joint status of the variables through time. These two problems are obviously related. For example, if NPI and COLL are stable through time, then factors which account for their earliest observed values should predict the latter values as well. Moreover, if the two variables are highly and positively associated, as earlier studies and prevailing organizational theories suggest, then factors that predict performance on one variable will, of course, predict performance on the other. What, then, do we know about the stability of each of these variables and their association through time?

Through-Time Variation in Outcome Variables

The cross-wave auto-correlations in Figure 2 show that the degree of stability of each variable varied depending upon the lag. The auto-correlations were uniformly moderate, suggesting, perhaps, some unreliability in the measurement procedures. However, we are pursuaded that the moderate strength of the autocorrelations has theoretical meaning, a point that will unfold with our report.

Figure 2. Autocorrelations For NPI and COLL



The lags with the greater lesser autocorrelations were different for NPI and COLL, and indicate that NPI was more stable within each year but that COLL was relatively stable only from the end of the first year to the beginning of the second year (T_3-T_4).

The pattern of associations between the two outcome variables changed at each wave. This is shown in Figure 3. The only sizeable within-wave correlations between the outcome variables appear at T_3 and T_5. Interestingly, the direction of the association was negative at T_3, but positive at T_5. These two findings mean that schools that were relatively high on NPI at T_3 tended to be relatively low on COLL, but by T_5, those that were relatively high on NPI also tended to be relatively high on COLL.

Figure 3. Within and Across Wave Correlations Between NPI and COLL

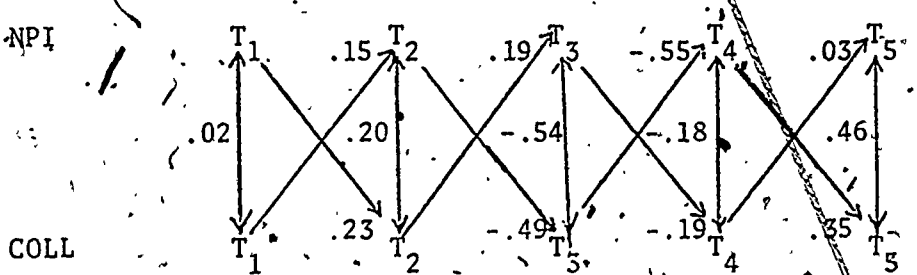


Figure 3 also shows that the cross-wave correlations between the outcome variables were typically quite low. The exceptions were the associations between NPI at T_2 and COLL at T_3 ($r = -.49$), between COLL at T_3 and NPI at T_4 ($r = -.55$), and between NPI at T_4 and COLL at T_5 ($r = +.46$). These observations indicate that schools which were high on NPI at T_2 were relatively low on COLL at T_3, those which were relatively low on COLL at T_3 were relatively high on NPI at T_4, and those which were relatively high on NPI at T_4 ended up relatively high also on COLL by T_5.

In sum, this correlational analysis tells us some important things: (1) neither variable was stable through time; (2) NPI and COLL were related, but (3) the degree and direction of the relationship changed from wave-to-wave, and (4) the predictability from one to the other across waves changed during the course of the study. Obviously, the early variation in NPI and COLL and their association offered no basis for predicting their later variation and association.*

We can depict this lack of predictability more simply. It was possible to form two groups of experimental schools based upon their performance on both outcome variables at T_5. Seven schools were considered to have been successful in their installation of the innovation due to their relatively high levels on both variables; eight other schools were considered unsuccessful because of their relatively low levels on both variables. Breaking the

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*The pattern of cross-wave associations was further evaluated using regression analyses (see Appendix A).

schools out this way essentially reflects the positive correlation between NPI and COLL that existed at T_5 and enables us to trace the status of each group on both variables back to the early stages of installation.

Table 1: Mean NPI and COLL Scores For Successful vs. Unsuccessful Schools (N = 15)

		T_1	T_2	T_3	T_4	T_5
NPI	Successful	2.3	5.6	6.8	5.8	6.0
	Unsuccessful	1.2	4.7	4.8	1.7	2.0
					*	*
COLL	Successful	19.2	27.1	34.9	40.9	58.3
	Unsuccessful	35.7	39.5	39.5	33.6	26.9
		*				*

*significant at @ = .05

Table 1 presents the means for each wave on NPI and COLL for these two groups. The two groups were virtually indistinguishable in performance on the outcome variables at T_2 and T_3, again pointing to the lack of predictability of T_5 NPI and COLL from early NPI and COLL. The analyses of the correlations and these means suggested we turn to other variables which held promise of prediction of T_5 NPI and COLL.

Other Potential Predictors of Outcome Variables

Two other sets of variables held promise of improving this through-time analysis of relationships among the outcome variables--Fixed and Strategic variables.

Fixed Variables pertain to features of schools which usually are not or can not be altered preparatory to or because of the innovation. We refer to such obvious characteristics as school size, the age and tenure of its administrative and teaching personnel, and to the number of differentiated components within a school.

Fixed features refer also to some less obvious characteristics. For example, the leadership style of the principal has been shown to vary from one school to another and, perhaps, also to be implicated in the innovation process. Moreover, some schools have higher rates of teacher turn-over than others. Also schools may be assumed to differ with respect to the salience of normative structures often identified with teaching faculties. Here we refer especially to the norms of autonomy and equality familiar to the reading audience of Dan C. Lortie.

The fixed features of a school are rather stable at least over the short haul. But across schools there can be considerable variability. Some staffs are older, are larger, are more progressive, or are more adaptable than others. Principals vary in experience, tenure, leadership style and in their relationships with a faculty. These differences may become more prominent in the innovation process, especially where increased levels of interaction are at stake.

Conceivably there may exist greater or lesser compatibility between an innovation and a school depending on their mutual characteristics. For example, increased collaboration might be contingent upon an open-space architectural

design. Increased collaboration may create higher levels of stress, which in turn may be borne easier by youth or experience, or by some combination of enthusiasm and pace.

Many of the obvious Fixed variables were measured as a matter of routine. Such features as the number and type of teachers, volunteers, and specialists, principal and teacher age, tenure, experience, teaching responsibility, school committee structure and staff turn-over were either reported directly in questionnaires or taken from school records. Principal leadership style, faculty norms, and the power structure of the school were estimated from archived measures, adapted for the project or with measures specially created for our purposes. Those are too numerous to mention and are described elsewhere (Packard, et al, 1976).

Strategic Variables refer to the set of special events undertaken during the planning phase. These have the apparent function of preparing the school and faculty for the installation of the innovation. We were especially alert to estimate the quality and quantity of teacher participation in the governance of decisions leading up to the installation of the innovation. Indeed, the importance of the participation of the users during the planning stage can be taken as another of the major discoveries in the study of educational reforms (Fullan, 1972; Lighthall, 1973). Participation in the governance of the project is thought to give users a sense of symbolic and quasi-legal mastery over the innovation. Special training exercises, such as contacts with consultants, and small and large scale workshops, can be seen to give users a sense of mastery over the technical contents of the

innovation. Supposedly, the greater the sense of mastery over the project by the users, the greater the likelihood of its installation. Administrator fostered, top-down innovations are thought to provoke high levels of teacher resistance to an innovation for its symbolic value and high levels of opposition to its content.

Estimates of the planning strategy in each school were taken mainly from numerous questionnaire items administered at the first data collection. This took place during the planning stage, at a point, to the best of our knowledge, after each school had been committed to an installation effort. We asked teachers to report on such things as who made the installation decision, how and how much teachers participated in and influenced this decision, and how much control the faculty collectively and the respondents individually believed they had over the course of the project and their involvement in it. We asked teachers to estimate the costs and benefits of the project, to say how difficult they felt the project would be for them, how easily they would be able to make certain unspecified transitions in role behavior, how satisfied various parties, including themselves, seemed to be with the planning process and with the innovation proper, and finally the degree to which they and others seemed to support the project.

Independently from these more subjective responses we sought also to obtain rather objective accounts of the number and types of workshops and consultant contacts that occurred during the spring and summer of 1974. (Summer data were collected at the second administration of the instruments.) Also on our visits to the sites we sought to determine if the classroom architecture

were open, closed or intermediate between these poles. These observations were made over the course of our data collections so that alterations could be detected and taken into account in analysis.

Finally we sought to ascertain who, if anyone, was key in promoting the innovation for each school, e.g., teachers, principal, district office, or outsiders. Most of these measures are described elsewhere, and, for brevity's sake, we shall not discuss them here.

The Relation of Fixed and Planning Strategy Variables to Performance on Outcome Variables

For this analysis each Fixed and Strategic Variable was correlated with the residual gain in NPI and COLL at each wave.* In Table 2 we show only the strongest correlations produced in the analysis.

Apparently, some of our expectations were fulfilled. Where satisfaction of teachers with the installation decision and their sense of mastery over

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*To calculate residual gains scores each outcome variable score T_2-T_5 was regressed on to its status at T_1. Using the unstandardized-score regression equation, we calculated the predicted scores for each wave in question. The predicted score for each school was subtracted from its corresponding observed value to produce residual scores. We thereby were assured that the correlations were not due to pre-treatment relationships among the Outcome variables and T_1 Fixed or Strategic variables.

Because we had measures of many more variables (60+) than cases (15) a number of data reduction strategies were employed. Key among these was to create blocks of Fixed and Strategic variables. In this procedure various theoretically related sets of variables were fashioned. One member was chosen as the dependent variable and the others were regressed onto it. Thus formed was an unstandardized-score regression equation, from which it was possible to construct an index for each block of variables for each school. These variable blocks are used in much of the discussion in this section.

Table 2

Correlation Coefficients Between the Outcome Variables (Residual Gains) and Selected Fixed and Planning Strategy Variables.

Fixed Variables	Residual NPI Gains				Residual COLL Gains			
	T_2	T_3	T_4	T_5	T_2	T_3	T_4	T_5
Size	.49*	.47				-.74		
Admin. Power	-.54							
Equality Norm		-.49						
Planning Strategy Variables								
Consultants					.56			
Decision Satisfaction		.52						
Fate Control		.57						

*Correlation coefficients greater than .51 are significant at the .05 level.

the course of the innovation were relatively high, we witnessed the greater gains in NPI by T_3; where consultants entered into the planning activities, we saw the relatively greater initial gains in COLL at T_2. Larger schools showed the greater gains in NPI by both T_2 and T_3 but the lesser gains in COLL by T_3. Schools where the power of the principal was lower showed the greater gains in NPI by T_2, those where the norm of equality was weaker showed the greater gains in NPI by T_3.

These results indicate that Fixed and Planning Strategy variables predicted performance on the outcome variables only through the Implementation stage. Thus, the characteristics of the school (Fixed variables) and the Planning Strategy seem to have only short term effects.

As it turned out, we could predict with some success the values of Strategic variables on the basis of Fixed variables. The influence of two Fixed characteristics, brevity of principal tenure and central office push, were evident in the quality and quantity of teacher participation in the planning phase. Namely, first year principals were associated with high levels of teacher participation in the planning stage. Central office push of the innovation was strongly and negatively associated with teacher participation in the planning stage. The zero order r's are .64 and -.82 for brevity of tenure and push respectively. Together the two variables explain more than 60% of the variance in teacher participation.

Moreover teacher satisfaction with their participation in the governance of decisions made during the planning stages was influenced by brevity of principal tenure, by central office push and by participation. In fact,

68% of the variance in decision satisfaction was explained by the combination of brevity of principal tenure and central office push. We concluded, therefore, that both teacher participation in and their satisfaction with the planning stage were exclusively determined by fixed features of the school.

Because numerous relationships existed also among the Fixed characteristics, we were disappointed that more of them did not show up as predictors of the outcome variables. However, further examination of the pattern of relationships among the Fixed characteristics themselves suggested we could form a typology of two groups of schools in our sample. As an attempt to better elucidate the relationships between the Fixed and Outcome variables, we formed the two sets of schools and then looked at differences between them on NPI and COLL. We first describe these two groupings as different domains of responsibility.

Small schools tended to have female principals, who in turn were regarded by their faculties as holding the balance of power over school affairs. These principals had relatively little administrative experience in comparison with their experience as teachers, but had relatively many years of tenure in their present positions. Such principals also scored high on desirable leadership characteristics. The faculties of small schools tended to be more stable and to emphasize norms of teacher autonomy and equality. For convenience, we refer to the schools that fit this characterization as domains of lesser administrative responsibility. In these schools, teachers tended not to participate much in the planning strategy, especially its governance. Rather, consultants were likely to be employed

in the planning stage and the innovation was pushed by officers of the school district hierarchy.

Large schools tended to have male principals. These principals did not appear to hold the balance of power in school affairs; they did not possess the desirable leadership characteristics to the same extent as their counterparts in small schools. These principals tended to have much administrative experience in relation to their teaching experience, but to have had only brief tenure in their current positions. The faculties of larger schools were less stable and had less salient norms of autonomy and equality. For convenience, we refer to such schools as domains of greater administrative responsibility. Here teachers tended to participate in the planning process, as there were fewer contacts with consultants and less central office push of the innovation.

In Table 3 we present the NPI and COLL means for these two groups of schools, T_2 through T_5.

Table 3

Mean NPI and COLL Values for Greater and Lesser Domain Schools

	NPI				COLL			
	T_2*	T_3	T_4	T_5	T_2	T_3*	T_4	T_5
Lesser Admin. Responsibility	3.0	4.5	2.8	3.3	33.7	50.9	41.5	45.1
Greater Admin. Responsibility	7	6	4.1	4	32.1	26.2	24.7	39.4

*Significant at @ = .05.
N = 12 schools of which six clearly fit into each category.

Schools in the category domain of lesser administrative responsibility made major advances in collegial decision-making but only minor advances in instructional interdependence during the Implementation stage. Schools in the domain of greater administrative responsibility made major advances in instructional interdependence, but only minor advances in collegial decision-making during the Implementation stage.

The two groups are not distinguishable on these Outcome variables in the Institutionalization stage. Obviously, these Domain groupings formed as a composite of Fixed school characteristics allowed us only the short-term predictability we found before.

The Relationship of Implementation Strategy Variables to Performance on Outcome Variables

Finally, we believed that ways in which schools attempted to install the innovation during the first year may have influenced the eventual success or demise of the enterprise. These early approaches constitute Implementation Strategy variables.

Location of Instructional Interdependence in the Curriculum

We examined the extent to which the instructional interdependence efforts centered in the Reading and Language Arts subject areas. Whether instructional interdependence was confined to a few subject areas had implications for the manageability and coordination of the faculty efforts.

By agreeing to install a unit organization, the schools had gained an opportunity to purchase curriculum materials developed by one of the major

sponsors of the innovation. At the time, the materials in Reading and Language Arts appeared to us to be the most amenable to a team work setting. Conceivably, the innovation had been "sold" in part on the integrity of the more developed Reading and Language Arts program, and early workshops likely had been held on Reading packages. Consequently, the early innovative efforts among teachers may have been prompted by a desire to effect improvement in this curricular area for which sophisticated new materials were available.

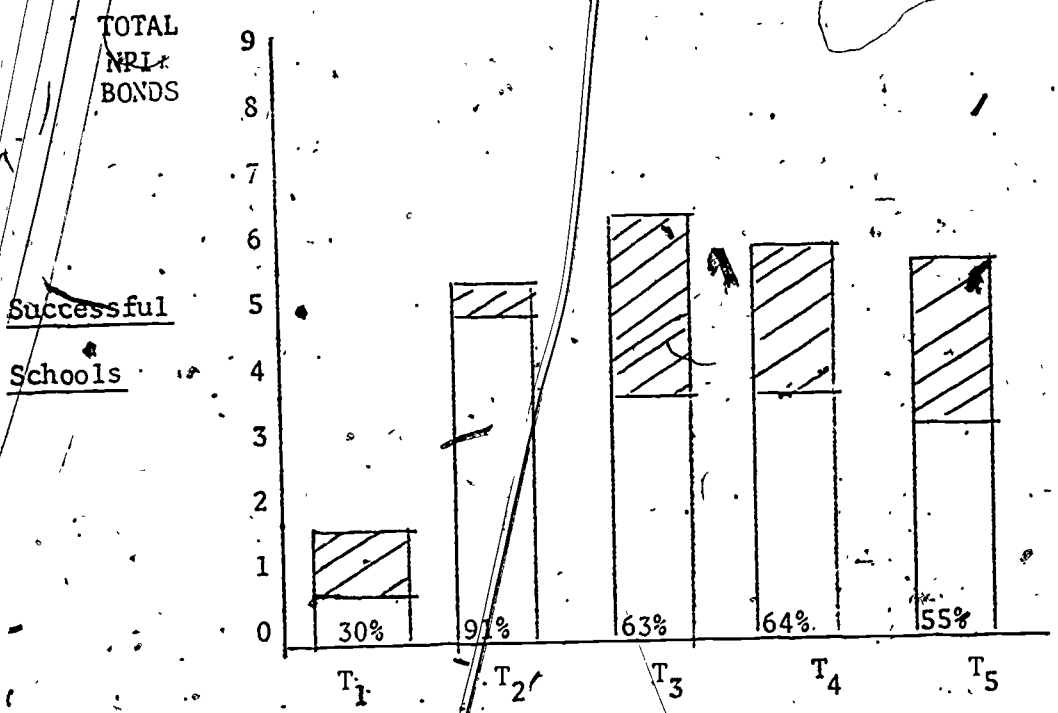
It is also conceivable that Reading and Language Arts comprise the curricular areas to which elementary faculties assign highest value and that Math, Science and Social Studies are of less central concern. We were struck by the possibility that if an innovation becomes attached to the core values of a particular occupational subculture it may thrive. If, on the other hand, an innovation is expressed in events somewhat removed from the core values of an occupational subculture, it may suffer from neglect.

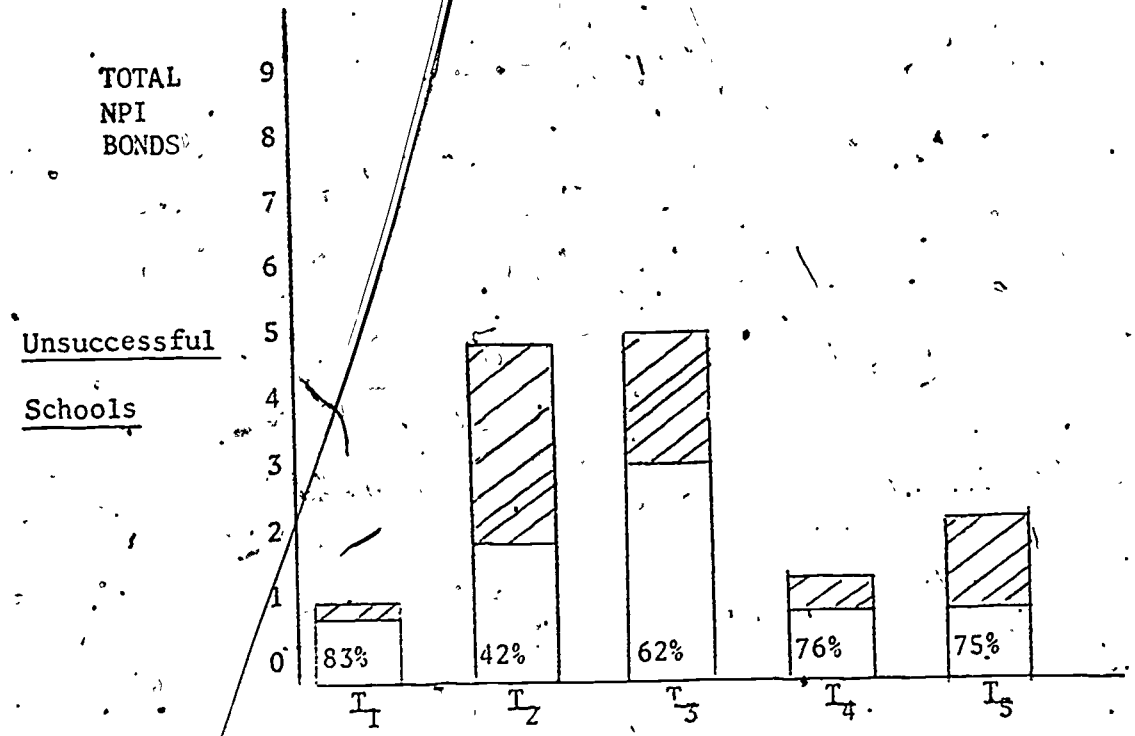
Table 4 presents, for Successful and Unsuccessful Schools, the average proportion of interdependent teacher-pairs that were exclusively in the areas of Reading and Language Arts. The height of each box represents the average number of pairs in interdependence over all subject areas, the unshaded area and percent depict the Reading-Language Arts emphasis.

Once units had been installed both sets of schools showed a dramatic shift in NPI. However, at T_2 only about 40% of the pairs in the Unsuccessful schools focused on Reading-Language Arts whereas nearly all the interdependent efforts in the Successful schools dealt with Reading-Language Arts.

Table 4

AVERAGE NUMBER OF INSTRUCTIONALLY INTERDEPENDENT PAIRS (NPI) AND PERCENT IN READING AND LANGUAGE ARTS





By T_3, the Successful schools had decreased their efforts in Reading-Language Arts and the Unsuccessful schools had increased theirs to the point that no difference existed in the proportion of NPI in these two subject areas exclusively.

Through the next year the Successful schools maintained this same degree of effort in Reading-Language Arts, although the total average number of interdependent pairs dropped slightly. The Unsuccessful schools showed a major abandonment of interdependent efforts back to the same level that existed at T_1.

The consequences of the early curricular focus in this innovation seem obvious. Where the efforts are attached initially to subject areas less central in the minds of teachers, or less emphasized by the program, the ability of the innovation to take hold in the school suffers.

Constitution of the Units

Various alternatives were open to the schools by which they could constitute their units. Units might vary in size, in the level and range of student age-grades, in the manner in which unit leaders were selected, in the characteristics of unit leaders, and in whether or not students were assigned to the individual members or to all members as a group.

Our data show that some units contained teachers and students at only one or two grade levels, others contained three or four grade levels. In some units, unit leaders were appointed by the principal; in others unit leaders were selected by unit members. Unfortunately, many of these features

were tied to the fixed characteristics of the school--multi-graded units, for example, occur naturally in small schools--and did not have much currency as predictors.

We assumed that the assignment of students to the unit as a whole would influence the performance on the outcome variables. If students were not assigned to individual members, then the unit would be faced with decisions, collegial by implication, regarding the assignment of students to class groups and to teachers. Such a condition might increase to the incidence of instructional interdependence. However, there was little variation on this account. In the vast majority of cases students were assigned to individual unit members.

Unit Involvement in the Innovation

It occurred to us that a relevant implementation strategy may have been the early level of involvement of each unit in the innovation and the pervasiveness of that unit involvement throughout the school. We therefore examined differences between the Successful and Unsuccessful schools in the frequency of team meetings, the degree and frequency of interdependence connections among unit members, the proportion of decisions made by the unit as a whole, and the proportion of units which had at least some of their members involved in instructional interdependence.*

*See Appendix B.

Our data revealed that, in the Successful schools, units were more involved in instructional interdependence from the outset. The Successful schools also had a greater proportion of their units with members engaging in instructional interdependence.

We cannot explain why these differences existed in the two groups of schools, but that they existed from the outset may indicate that if more teachers become involved initially in the innovative activity, the better the chances for success. By the second year, instructional interdependence in the Unsuccessful schools, in units where it did occur, was confined to isolated pairs of teachers. In the Successful schools, it more properly characterized the group of teachers comprising the unit.*

Conclusions

By distinguishing two types of experimental schools on the basis of their relatively invariant pre-unitization characteristics, we could predict performance on the outcome variables through the end of the Implementation stage but not beyond. Characteristics included to comprise the distinction

*Two of the unsuccessful schools officially disbanded their formal unit organization between T_4 and T_5. In one case this seemed to be an attempt to alleviate parent criticism against the unpopular practice of having children from different grade levels in the same class. In the other case, it seemed to be related to staff disaffection with the organizational structure. In the context of the argument we are developing above, these actions might be interpreted as indicating the relative unimportance of unit membership to the staffs of the unsuccessful schools.

were school size, principal sex and tenure, and faculty norms concerning autonomy and equality.

One assumption that had shaped our thinking throughout the project was that teacher participation in planning for the innovation would affect subsequent performance on the outcome variables. Specifically, we were persuaded that teacher participation would be positively associated with ultimate gains in both instructional interdependence and collegial decision making.

Our examination of such pre-unitization activities revealed that some provided a measure of predictability to the end of the Implementation stage only. These included the use of consultants, teachers' sense of mastery over the course of the innovation, and teachers' satisfaction with the decision process about installing the innovation. Teacher satisfaction itself was in turn strongly contingent upon the level of teacher participation in that decision process.

We were also led to discover a degree of predictability of these planning strategy variables from the relatively fixed characteristics of the schools. It is not surprising that strategies of innovation appear to be linked to the ongoing characteristics of schools. School size alone can limit the alternative open to an administrator and staff. The autonomy that a school enjoys from central office control can create opportunities that otherwise are not granted to schools that are overseen closely. However, these apparently important distinctions among schools seemed to have little or no long-term effect on success in innovation.

The relationship suggests that planning strategies a school may use are determined by its more invariant characteristics. Furthermore, the lack of predictability beyond the first year suggests that the importance of planning strategies to success in innovation should be re-evaluated.

Examination of the experimental schools at the end of the first year indicated that those showing the greater gains in interdependence bonds tended to also show the less substantial gains in collegial decision-making. By the end of the second year, the schools showing the greater gains in interdependence bonds also showed the more substantial gains in collegial decision-making.

Perhaps these observations indicate that it is difficult to make initial, substantial gains in both of these outcome variables. Each variable describes an element of work relations among teachers. Greater task interaction may lead to greater stress and anxiety. The interpersonal work environment may become more complex.

What then might account for the observation that some schools made substantial gains in both outcome variables in the second year of the project? Clues to this answer are meager. One clue seems to reside in the choice of subject matter. In schools where the innovation was first expressed through gains in instructional interdependence in Reading and Language Arts, the innovation thrived over the long term. Where the innovation was first expressed in the less central subject areas, it flourished only briefly.

Perhaps managing more intense interpersonal work relations around Language Arts and Reading is less stressful owing to a collaborative tradition in these subjects. Perhaps managing more intense work relations in

these subject areas is seen as more beneficial to students, a service that outweighs personal costs.

There are some indications that faculties which ultimately managed gains on both outcome variables were older and had spent more time together in the school than faculties that cut their innovative efforts back. Perhaps increased interpersonal work contact is not as stressful among acquaintances as among relative strangers.

Of course, it may be only a chance occurrence that the innovation was attached to language arts and reading in some schools and not others. These subjects may have a longer tradition of grouping and regrouping students for instruction and, thus, a longer tradition of collegial decision making among teachers. If a school should begin its innovative efforts in these subject areas, tradition alone may have produced the conditions ripe for the expression of this particular innovation.

We also know that after the installation of units, instructional interdependence was a more school-wide unit-level phenomenon in the Successful than in the Unsuccessful schools and remained that way. By the second year, the nature of the interdependent relationships in the Unsuccessful schools became typically an isolated teacher-pair phenomenon. This suggests that the faculties of the more successful schools were predisposed to collaborative behavior. Their counterparts in the less successful schools were not, at least to an appreciable degree. Familiarity may be an important precursor to higher levels of task interaction among teachers.

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APPENDIX A

Lagged Regression Analyses: NPI and COLL

The series of lagged regressions are presented in Figure 1. Due to the small number of schools, NPI and COLL at Tn were each regressed only on to two independent variables at Tn-1; one was its own previous status at Tn-1, the second was the other variable at Tn-1. For each lag, diagrams labelled A depict the regressions of COLL at Tn on to COLL and NPI at Tn-1. Those labelled B depict regressions of NPI at Tn on to NPI and COLL at Tn-1. Each lagged effect is represented by beta weights and, in parentheses, the increments in proportion of variance explained.

Most betas and increments in the diagrams were significant at alpha = .05, df = i2, These are indicated by an *. For some lags, the betas and increments were nonsignificant but the increment was sufficiently larger than it was at other lags where no significance was found that we chose to consider it as being substantial. Such instances are indicated by a #.

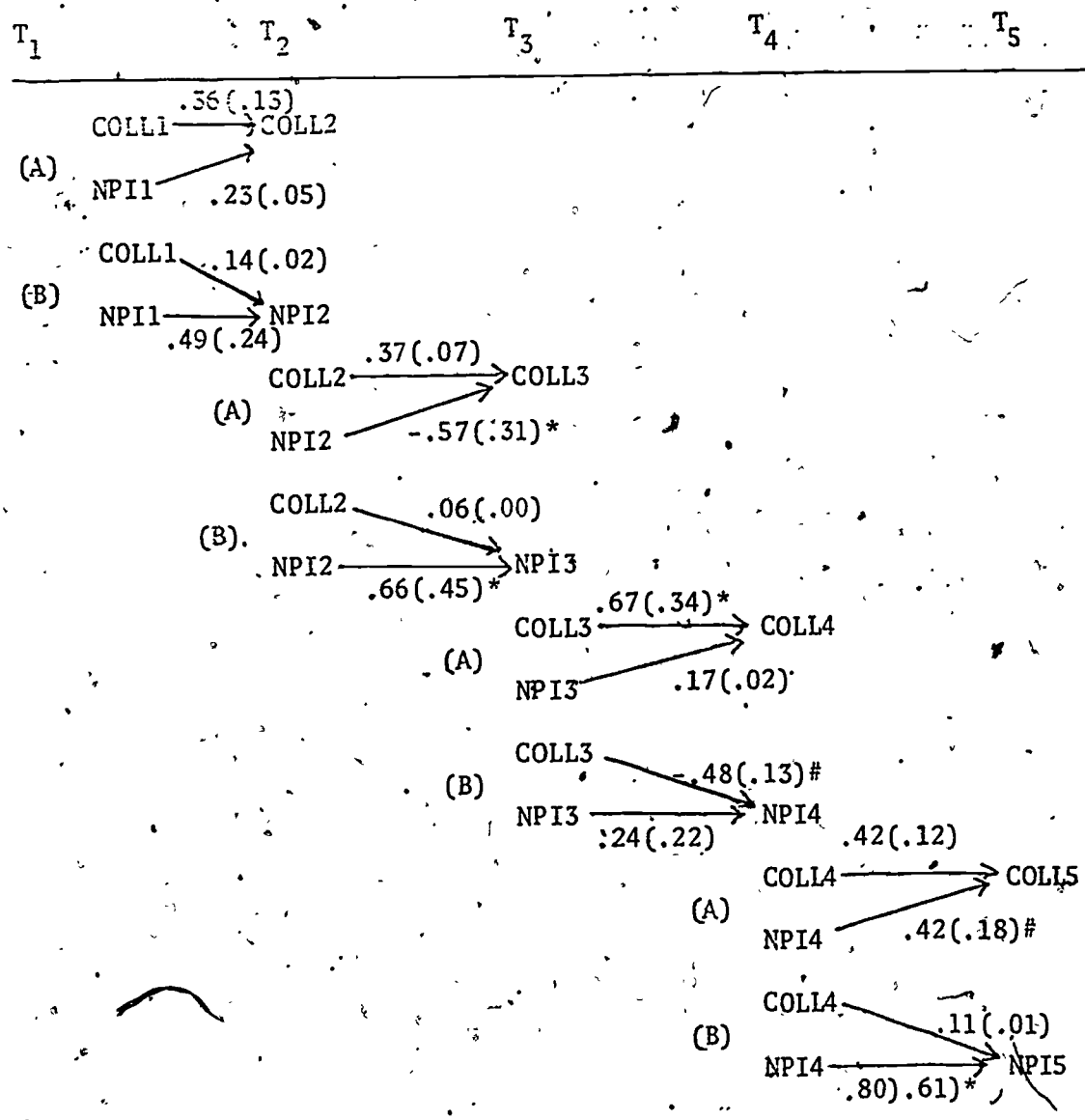
The analyses confirmed the presence of discontinuities in the relationships across waves between NPI and COLL:

(1) NPI at the beginning of each year was positively related to itself at the end of each year respectively,

(2) NPI at the beginning of the first year inversely predicted related to COLL at the end of the first year whereas NPI at the beginning of the second year positively predicted related to COLL at the end of the second year,

(3) COLL at the end of the first year inversely predicted NPI at the beginning of the second year--this was the only substantial prediction of NPI from COLL.

Figure 1. Regression Analyses: NPI and COLL



APPENDIX B

Unit Involvement in the Innovation--Collegial Decision-Making and Interdependence

One of our items asked teachers to indicate whether responsibility for each of several decision areas normally rested with team members jointly. From the usable data (several areas had to be discarded because of missing data), we constructed an index which essentially reflects the percent of the decision areas in the school for which team members were jointly responsible. These data are presented in Table 1.

Table 1: Percent of Decisions Made by Unit Members Jointly

	T_2	T_3	T_4	T_5
Successful	27.7	34.1	27.5	31.2
Unsuccessful	23.5	29.8	21.2	18.1

Although a hint of a difference in the expected direction appeared at T_5, no differences were evident in the Implementation stage. (None of the differences are statistically significant at @ = .05, one tailed, d.f. = 11.) The results do not confirm our expectation, that decision-making by the unit as a whole was greater in the more successful, particularly at the Implementation stage. Apparently, the unit involvement in the decision-making arena was not a strategy that initially, at least, distinguished the Successful from Unsuccessful schools.

A striking consistent difference between the more and less successful schools was observed in the manner in which their units fashioned instructional

interdependence. To explain, we computed two different indexes for each unit:

(1) extensity is the proportion of observed total possible instructional interdependence bonds in a unit. Scores could range from zero (no unit members in a bond) to 1.00 (each member in a bond with each other member).

(2) intensity is the average number of days a bond was observed. Aggregated over five subject areas, scores could range from zero to 50. The maximum would occur when the observed bonds remained for 10 days (the period of observation) in each of five subject areas. Obviously, if the extensity were zero, a unit could have no intensity.

The school scores were then computed as means of these unit scores. Table 2 presents the extensity and intensity scores for Successful and Unsuccessful schools.

Table 2: Extensity and Intensity of Interdependence in Units

	T_2	T_3	T_4	T_5
Extensity				
Successful	.54	.50	.48*	.64*
Unsuccessful	.38	.35	.14*	.24*
Intensity				
Successful	6.73	8.19	9.10	11.22
Unsuccessful	7.85	8.13	11.95	10.31

*Significant for @ = .05, d.f. = 11, one-tailed.

Although the T_2 and T_3 differences in extensity are not statistically significant, the consistently larger values in the successful schools seems to be meaningful. In successful schools more unit members were involved in the new work arrangements at the same level intensity as those in the less successful schools.

The extensity values in the less successful schools indicate that interdependence occurred among isolated pairs in units; the level of intensity in these schools at this time, then, reflects pair-wise interdependence rather than unit-wide interdependence. By the second year, interdependence had devolved into a pair-wise phenomenon in the less successful schools but remained a unit phenomenon in the more successful schools.

Furthermore, we thought that the pervasiveness of early involvement of units in interdependence in a school also had implications for the eventual success of the innovation. With more units participating, the innovation truly becomes more a school level effort rather than an isolated-unit or isolated-pair effort. Table 3 presents the mean percentage of units in less and more successful schools whose members engaged in some measureable level of interdependence (extensity greater than zero).

Table 3: Percentage of Units with Extensity Greater than Zero

	T_2	T_3^*	T_4^*	T_5^*
Successful	60.5	62.9	72.9	63.6
Unsuccessful	36.1	36.1	25.0	27.8

*Significant at @ = .05, d.f. = 11, one tailed.

Obviously the Successful schools show consistently more pervasive unit activity in teaming at each wave than do the Unsuccessful schools. The percentages don't change much within each group except for the drop at T_5 in the Unsuccessful schools.

Not only did the more successful schools begin with a greater involvement of units, but the units that were involved tended to show more extensive interdependence activity at an intensity equal to that of the less successful schools. It appears that during the Implementation stage the more successful schools attempted to make the work-system feature of the innovation a unit-wide and a school-wide venture. This initial effort eventuated in a more successful installation of the innovation.