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Toward an understanding of stress in the classroom: The role of individual differences and physical design factors

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IRVINE

Toward an Understanding of Stress in the Classroom: The Role of Individual Differences and Physical Design Factors

DISSERTATION

submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in Social Ecology

by

Gregory M. Jue

Dissertation Committee:

Professor Gary W. Evans, Chair

Professor Ross F. Conner

Professor Daniel Stokols

1990

The dissertation of Gregory M. Jue is approved,
and is acceptable in quality and form
for publication on microfilm:

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1990

DEDICATION

To my parents, for providing me with the map.

To Lauren, for being my navigator.

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ACKNOWLEDGMENTS

This dissertation, as is the custom, signals the culmination of the author's academic apprenticeship and serves as a stepping-off point for other professional ventures. As such, this manuscript represents much more than the completion of a single research project. I am indebted to many individuals for the support they provided, both indirect and direct, during my years as a graduate student. Too numerous to cite by name, they include colleagues and acquaintances with whom I have had the extreme pleasure of being associated. Their contributions ranged from offering helpful insights into particular research problems to providing simple words of encouragement. I would like to pay special recognition, however, to the following persons without whose assistance this dissertation would not have been possible.

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ABSTRACT OF THE DISSERTATION

Toward an Understanding of Stress in the Classroom:
The Role of Individual Differences and Physical Design Factors

by

Gregory M. Jue

Doctor of Philosophy in Social Ecology
University of California, Irvine, 1990
Professor Gary W. Evans, Chair

There has been increasing recognition in the educational research literature of the role played by the physical environment in the learning process, including possible contributions of classroom design factors to childhood stress. Most of this research suffers from a failure to adequately consider how intraindividual capacities and abilities may moderate environmental impacts. The present study proposes that the effects of school settings on children can best be understood from an interactionist perspective that assesses the joint influence of individual differences and physical design factors.

Individual differences (coronary-prone behavior pattern and arousal-seeking tendency) and environmental factors (classroom density, openness of perimeter, window area, desk arrangement, and the presence or absence of secluded study space) were examined as predictors of four measures representing some of the behavioral and psychological costs of adapting to stress (absenteeism, task inattention, fidgeting behaviors, and cooperativeness). The data analyzed were

collected from 110 children, representing 14 elementary school classrooms, via a variety of methods: student interviews, behavioral observation of students in the classroom, teacher questionnaires, and detailed surveys of the physical classroom setting. For the most part, multiple regression analyses showed that predicted interactions between individual differences and design factors made significant contributions to the explained variance in the outcome measures, after statistical adjustment for the main effect contributions and the variance due to the social and instructional context of the classrooms (as measured by the Classroom Environment Scale). In addition, scores on the outcome measures were determined by different combinations of person and environmental variables.

While methodological shortcomings associated with the use of a nonequivalent control group design limits the interpretability of the findings, the results provide preliminary empirical support for current transactional models of stress and coping. Furthermore, this study extends the research literature by suggesting that an interactionist formulation may yield significant effects that otherwise may be obscured by only examining the main effects of classroom conditions on learning in children. The interaction of person and environmental variables may provide more explanatory power than is afforded by a separate examination of either person or setting variables alone.

INTRODUCTION

> Sociologists agree that one of the worst things that can happen to an American child nowadays is youth.
>
> Russell Baker, 1966

Stress and anxiety are inextricably woven into the fabric of our modern technological society. Broadly speaking, stress can be regarded as an adaptation process whereby an environmental event or force is perceived as being threatening to an organism's existence and well-being, and the organism responds to this threat (Baum, Singer, & Baum, 1981; Lazarus, 1966; Selye, 1956). Response to life's "daily hassles" (Lazarus & Cohen, 1977) – overcrowding, air and noise pollution, commuting, and other chronic problems – may have significant psychological and physiological costs to the individual over the long term, including depression, coronary heart disease, neurotic impairment, and infectious diseases.

Of late, considerable attention has been paid to the impact of stressors on children. There is an increasing amount of evidence that when adults are struggling to cope with stress, they are prone to pass on their anxieties to their children in the form of demands that they work harder and play less, be more serious, and achieve at too high a level and in unfamiliar fields (Humphrey & Humphrey, 1985). Children are being pressured to grow up faster. As stated by Elkind (1988):

> The concept of childhood, so vital to the traditional American way of life, is threatened with extinction in the society we have created. Today's child has become the unwilling, unintended victim of overwhelming stress – the stress borne of rapid, bewildering social change and constantly rising expectations. . . . If child-rearing necessarily entails stress, then by hurrying children to grow up, or by treating them as adults, we hope to remove a portion of our burden of worry and anxiety and to enlist our children's aid in carrying life's load. We do not mean our children harm in acting thus – on the contrary, as a society we have come to imagine that it is good for young people to mature rapidly. Yet we do our children harm when we hurry them through childhood. (p. 3)

While children's lives have always been stressful, investigation of the tensions experienced by today's youth is germane for a number of reasons. First, the number and severity of childhood stresses has increased dramatically over the past decade (see e.g., Brenner, 1984). Bureau of the Census (1982) statistics indicate that the number of youngsters living in single-parent homes has doubled; there also has been a fourfold increase in the number of children living with mothers who have never been married. These findings suggest that children today have fewer sources of adult support and affirmation than in the recent past. Second, children are not likely to cope with stress as well as adults because they have fewer strategic options available to them. For example, adults can often withdraw from stressful situations, but this same freedom of movement is usually denied to children. Adults can be angry with children, but an open display of anger directed at their elders is considered unacceptable for children. Third, childhood stress as a subject of research is pertinent because the specific coping mechanisms used by adults may have early developmental precursors.

A number of specific stressors of childhood have been studied in depth, including the impacts of parental divorce (Wallerstein & Kelly, 1980), child abuse and neglect (Helfer & Kempe, 1976), and childhood illness and hospitalization (Blom, 1958). The pressures associated with educational settings also may provide a rich source of information, for a major portion of a child's waking hours is spent in school. From kindergarten through the twelfth grade, the average young person will spend approximately 14,000 hours in the classroom (Gump, 1978). A wide range of stressors, both acute and chronic, occur in school settings. The anxiety they provoke can interfere with learning and is a major impediment to achievement. Whatever can be done to reduce stress in the classroom should serve as a spur to learning. Unfortunately, teachers tend to first identify sources of potential stress in settings outside of school before recognizing stressors occurring at school (Blom, Cheney, & Snoddy, 1986).

Educational researchers have traditionally studied stressors that may be subsumed under the global category of cognitive-social aspects of the classroom setting, such as corporal punishment (Clark, Liberman-Lascoe, & Hyman, 1980), peer-relations that include bullying and victimizing (Olweus, 1978), and academic pressure and excessive competition (Slavin, 1980). More recently, there has been increasing recognition of the role played by the physical environment in the learning process. Physical features of the classroom setting that have been studied include acoustics, lighting, climate, density, seating position and arrangement, and a variety of architectural properties such as openness, privacy, and fenestration. There is a growing literature on the effects of such variables on learning itself, feelings about learning, and social behavior related to learning. Less abundant is research which examines the effect of the physical environment on the health and stress aspects of learning.

Potential sources of environmental stress in schools are reviewed in the first section of this chapter. To the extent that physical qualities of the classroom contribute to the actual or perceived disparity between environmental demands and a child's adaptive resources, stress will result. For instance, clustered seating arrangements tend to facilitate social interaction; such arrangements, however, may be stressful for students who require privacy from others during study. Manifestations of children attempting to manage stressful transactions in educational settings may include increases in disruptive behaviors, inattentiveness, and absenteeism; poorer task performance; lower self-esteem; and heightened aggression.

The second section of this chapter discusses methodological and conceptual shortcomings typically found in the research literature. These limitations have made it extremely difficult to draw firm conclusions about the ways in which the physical classroom environment is stressful for children. Methodological problems range from fundamental issues such as the inability to randomly assign subjects and control independent variables, to more complex matters such as the over-reliance on self-report data and achievement tests. Conceptually, past research has been limited by rather restrictive operational definitions of the independent variables, among other criticisms.

The review of the literature will show that prior studies have relied heavily on models in which responses to stress are seen as moderated by the nature of the physical environment, without much regard given to the intraindividual resources of the children. Furthermore, little attention has been paid to the possible mediating effects of the social and instructional context of the classroom. These oversights may be partially responsible for the ambiguous and conflicting research findings. As described in the final section of this chapter, the present study suggests that the effects of school settings on children can best be understood from an interactionist perspective that considers the joint influence of individual differences and physical design factors. This view is consistent with process-oriented models which conceptualize stress in terms of a relation between person and environment, emphasizing the interactive nature of stressful transactions (Lazarus, 1966; Lazarus and Folkman, 1984). Implicit in these theories is an assumption that there exists an optimal match between a student's needs and the resources available in the classroom. The better the "fit" between a child and the environment, the more effectively that child can cope with stressful events. The intent of the present study is to uncover preliminary empirical evidence within naturalistic classroom settings supporting this notion of person-environment fit.

Environmental Sources of Stress in School Settings

Various features of the physical environment of schools have been studied by researchers. Early efforts focused on the establishment of minimum standards for classroom size, acoustics, lighting, and heating. Changes in design philosophy over the past two decades have prompted educators to raise questions about other dimensions of the physical environment, including windowless classrooms and open classroom construction. Studies of school settings also have examined a diversity of cognitive, social, and psychological outcomes: task performance and achievement, class participation, disruptive behaviors, task attention and distraction, perceptions of crowding and noise, class satisfaction, patterns of space utilization, and task persistence and motivation.

In this section is reviewed research on classroom density, school size, degree of enclosure, seating position and arrangement, windows, secluded study space, climatic and luminous conditions, noise, and aesthetic amenities. This review is not intended to be exhaustive (see Gifford, 1987; Weinstein, 1979, for more extensive surveys). Instead, representative research in the field is discussed with critique offered on the particular methodologies and theories used. Laboratory experiments are included only when further refinement or interpretation of field study findings is needed. In addition, this review is limited to studies in elementary and high school settings. Studies in college settings, while quite extensive and informative, are excluded. Besides the obvious differences in age and cognitive skills between students in elementary/secondary and post-secondary schools, these students differ markedly in the amount of personal control they typically possess. As control appears to be a strong mediator of stress and coping (Cohen, 1980; Averill, 1973; Glass & Singer, 1972), the intent here is to focus on those individuals who have little choice or control within their educational settings.

Classroom Density

Research on the effects of density in educational settings has been concerned primarily with task attention, overall satisfaction, and social behaviors. For example, kindergartners who crowded around a teacher to listen to a story were less attentive than when they were more dispersed (Krantz & Risley, 1972). The kind and amount of activities that students engage in are influenced by varying spatial density (Smith & Connolly, 1980). Shapiro (1975) found a curvilinear relationship between floor space per student and noninvolved behavior in nursery school classrooms. Noninvolved behavior was more frequent in classrooms where the space was less than 30 square feet per student or more than 50 square feet per student. Such behavior was less frequent in moderately crowded conditions (between 30 to 50 square feet per student). A number of other studies have shown a similar social withdrawal phenomenon among children in high density situations (e.g., Loo, 1972; Preiser, 1972).

In a study of elementary school classrooms ranging in size from 25 to 33 square feet per person, Ahrentzen (1981) found that students failed to report more restricted movement and perceived crowding in the denser environments. On the other hand, under high density teachers described themselves as being more crowded and distracted by physical contacts. Similarly, Ahrentzen (1980) found differences between students' and teachers' reactions to density in classrooms with seating arranged in clusters. A large number of desks per cluster made students feel more distracted and crowded than teachers, whereas smaller clusters made teachers feel more distracted and crowded than students. This divergence in reactions to density presumably was due to the different ways in which students and teachers utilize space in the classroom. Children who spend much of their time working at their desks also spend more time in close contact with other students when desks are arranged in large clusters. Such contact may be disruptive and distracting. Large clusters of desks also are commonly associated with greater amounts of open floor space. Thus, for teachers who spend a great deal of time circulating within the classroom, the added area may provide them with more space to move without bumping into others or having to squeeze between rows of seats.

Research examining the impact of classroom density on aggressive behavior has produced mixed results. Many of these investigations have drawn a distinction between social density (varying the number of individuals in a fixed space) and spatial density (varying the amount of space available to a fixed number of individuals). In a short-term experimental study, Loo (1972) found that children in high spatial density conditions showed less group involvement, more time in solitary play, and decreased aggressive behavior. Hutt and Vaizey (1966) examined the effects of increased social density on normal, brain-damaged, and autistic children. Despite a small sample size, they found that higher social density led to increased aggression in autistic children. Autistic children under high density also spent more of their time along the periphery of the room. In contrast, McGrew (1970) examined the effects of both spatial and social density on nursery school children during free play and found no significant differences in physical contact under any density condition. Under conditions of high social density, however, children adjusted their interpersonal spacing so that the same distance between individuals was preserved.

The apparent discrepancy in these findings may be due to the moderating influence of other factors such as the teacher and the educational program, the availability of resources, and architectural features of the classroom. Smith (1975) suggested that the amount of play equipment available to each child is a critical intervening variable in density studies. Increased social density may result in greater competition for resources that have not been increased. Similarly, in preschool settings, Smith and Connolly (1977) found no increase in aggressive behaviors in high density conditions when the number of toys per child was held constant. Rohe and Patterson (1974) found that children in high-density plus high-resource situations were less aggressive than children in high-density plus low-resource situations.

The teacher and the educational program also may modify the effects of density. In a study of eight open education classes, Rivlin and Rothenberg (1976) examined patterns of classroom spatial utilization. Employing behavior mapping techniques and interviews, they found that students converged in a limited portion of the total space, generally close to the teacher. This finding, coupled with interview data which showed a perceived lack of space, may indicate that perceived crowding may be due not to a lack of physical space but to an uneven utilization of available space. Density may impact performance when tasks require mobility or physical interaction among individuals (Heller, Groff, & Solomon, 1977). In addition, Haines (1985) found that under high density, students whose territoriality was encouraged (e.g., students were given name tags to affix to their desks) learned more than students whose territoriality was not encouraged (e.g., students were discouraged from personalizing their desks).

Ahrentzen (1981) found that teachers in classrooms with more open perimeter space reported less perceived crowding. Teachers in classrooms with greater ceiling height reported fewer distractions from physical contacts with students, although there were no differences in actual physical contacts during the observation period. Thus, architectural modifications to ceiling height or the degree of enclosure may distort perceptions of space and consequently may affect perceptions of crowding.

In summary, previous research suggests that density does not have a uniform effect across all classroom situations. Although spatial density has been demonstrated to be related to various student behaviors and teacher perceptions, other variables may mediate this relationship, including: seating arrangement, spatial utilization patterns, availability of resources, the educational program, ceiling height, and the openness of the classroom perimeter. Additional research on the impacts of density is needed, especially since class size has a tendency to increase as school districts wrestle with budgetary belt-tightening. Factors other than spatial and social density may influence perceptions of crowding. For example, the temporal dimension of crowding needs to be investigated. For both students and teachers, classroom density can fluctuate continually due to rotating classes, team teaching, and the availability of other activity centers outside of the classroom. In addition, there is recent evidence that events within the child's school and home domains are interdependent (Cohen, Evans, Stokols, & Krantz, 1986).

School Size

In a study of five high schools ranging in size from 35 to 2,300 students, Gump and Friesen (1964) found that school size can influence several aspects of learning. Larger schools, for example, offered a wider variety of instruction to their students. Furthermore, students in smaller schools participated in more kinds of extracurricular activities and they more often held positions of responsibility. In a more extensive study, Barker and Gump (1964) examined over 200 high schools in the Midwest and found that students from smaller schools were more likely to participate in extracurricular activities, were more satisfied with participation in school, had more positive self-images, showed greater personal responsibility, and were more sensitive to the needs of others. These differences were attributed to distinctions in staffing levels of the schools. According to this conclusion, a condition of understaffing exists when the number of members in a setting falls below a minimum maintenance level, forcing some or all of its members to assume a larger number of roles in order to maintain the setting. On the other hand, the setting is considered to be overstaffed when the number of members exceeds the capacity of the setting (cf. Wicker, McGrath, & Armstrong, 1972; Barker, 1968). In general, students in small schools may find that they need to take on additional responsibilities and as a consequence may be more valued. When the staffing of activities is about equal in large and small schools, typical experiences (e.g., involvement, challenge, skill development, and being valued) also are nearly commensurate (Wicker, 1968).

While research on school size and staffing in secondary schools is quite extensive (see also Baird, 1969), comparable studies in elementary and middle schools have not been undertaken. In addition, other outcome measures such as achievement, vandalism, and social attitudes have been neglected by previous studies, yet these variables seem particularly relevant for research examining the impacts of staffing levels in educational behavior settings.

Degree of Enclosure

Over the past three decades, many classrooms have been constructed without conventional walls and questions have been raised about their effectiveness. Most of the research in this area has concentrated on measuring achievement outcomes. There is no conclusive evidence, however, that either open space or traditional school designs enhance performance. For example, two large-scale studies show that the relationship between openness and achievement is not a simple one. The first, conducted in Sweden in 1976 by Gron, Bertil, and Engquist (cited in King & Marans, 1979), involved 4,500 elementary and junior high school students in 160 open space and traditional classrooms. Employing 60 testing instruments, they found that students with good academic records performed better on achievement tests in open space classrooms whereas students with poor academic records and psychological problems scored better on these tests in traditional schools. The second study, which involved 367 teachers and 1,078 students in 24 elementary schools of both traditional and open design, found no differences in achievement scores (Metropolitan Toronto School Board, 1972).

Research on the effects of openness on achievement also has been conducted on a smaller scale. Weinstein (1979), in reviewing many of these studies, noted that the findings range from no significant differences in the achievement records of students in open space and traditional classrooms (e.g., Grogan, 1976; Warner, 1971; Olson, 1973), to conclusions that open space schools are associated with lower achievement scores (e.g., Townsend, 1971; Bell, Switzer, & Zipursky, 1974; Ward & Barcher, 1975), to findings of greater performance by students in open classrooms (Day & Brice, 1977; Killough, 1972).

Explanations for these conflicting findings may be found by examining several conceptual and methodological shortcomings of previous research efforts. First, many studies have failed to make clear whether the investigators were measuring the effects of building layout, of teacher-student relations, or of something else

(Horwitz, 1979). It is important to distinguish between open versus traditional *facilities* and open versus traditional *educational philosophies.* Second, in most studies, classrooms have been given dichotomous labels (e.g., "open space" or "traditional"), misleading the reader to believe that schools are designed in two patterns only. In fact, there is a continuum of classroom openness-containment. The conventional designations have made comparison of research findings difficult: Is an "open" classroom in one study similar to that in another? Nominal-level measurements of classrooms also compound within-group error. Finally, the over-reliance on achievement scores by previous studies has been made at the expense of other outcomes that may be equally important to the student. This latter point will be discussed afterward in more detail.

Recent studies have tried to address some of these limitations. Evans and Lovell (1979), for example, examined student behaviors in an open space high school in which variable-height, sound-absorbent partitions had been installed to redirect traffic and define class boundaries. Employing a nonequivalent control group design, they found that with the physical modifications, the frequency of classroom interruptions was reduced and substantive, content questioning by students increased. These findings suggest that clearly demarcated classroom boundaries can convey a connotative message to students about the kinds of behavior which are appropriate in particular spaces. Brunetti (1972), in making a distinction between open facilities and open teaching methods, concluded that both the physical environment and the educational program were influential in determining students' perceptions of noise and distraction.

Reiss and Dyhaldo (1975) hypothesized that open space would promote persistent task behavior. They reasoned that the capacity of a stimulus to disrupt on-going behavior may be expected to habituate with prolonged stimulus exposure. Consequently, a relatively intense external stimuli might be required to distract students in open space schools, assuming that such schools have higher visual and aural stimulation. As expected, they found that elementary school students from open classrooms worked more persistently on puzzle tasks than students from traditional classrooms. There were no significant differences in reported locus of control between students in the various settings, which suggests that the greater task persistence shown by students in open space classrooms was not influenced by beliefs concerning the contingency of one's actions. For boys, persistence also was positively related to achievement: boys who remained relatively nonpersistent learned less in open space classrooms as compared to those in more traditional environments. While this study did not adequately control for possible selection bias, it demonstrates that effects due to classroom design factors may be present when learning outcomes are broadened beyond standardized achievement tests.

Alternatives to conventional achievement tests have been employed in other investigations as well. For example, Gump and Good (1976) examined the amount of time students spent in nonsubstance activities (e.g., moving, waiting, getting organized) at two traditional and two open space schools. They found that first- and second-graders in the open space schools spent a much larger percentage of their time involved in nonsubstance activities compared to those in the traditional schools. Similarly, the degree of enclosure had an effect on fifth- and sixth-graders, although these differences were not as pronounced.

Ahrentzen (1981) examined various aural, visual, and kinetic distractions in classrooms rated along an openness-containment continuum. The perimeter of each classroom was measured in terms of the length of permanent walls, nonpermanent or demountable walls, and open perimeter space. She found that teachers in classes with a high percentage of demountable walls reported more aural and visual distractions, higher levels of perceived crowding, and lower satisfaction with the learning environment. Teachers in classrooms with a high percentage of open perimeter space reported less crowding and greater satisfaction, but their students were less satisfied with these classrooms. Furthermore, teachers who restricted certain class activities for fear of disturbing others were found predominantly in classrooms having a larger percentage of nonpermanent walls. Ross and Gump (1978) also have developed an interval-level measure of openness, described in more detail below.

The need to match educational programs and school facilities recently has received some attention. Traub, Weiss, and Fisher (1977) differentiated open education from open space in a study involving 30 elementary schools in Ontario. They found that teachers in schools with both open programs and open architecture had higher positive attitudes than those in the other schools. Teachers in open space schools interacted more frequently with other teachers, and their students had higher positive attitudes towards school, teachers, and themselves. Similarly, Gump and Ross (1977) found that teacher attitudes were most positive when team teaching methods were adopted in open space schools.

Ross (1980) evaluated a number of design modifications made within 21 open plan elementary schools. She found that teachers in these schools attempted to adjust and modify their buildings to be more synomorphic or compatible with the type of educational program they employed. When the program was traditional, significant reductions in the level of openness generally were made. In her study, Ross used the "openness quotient" (Ross & Gump, 1978) as an indicator of containment. This interval-level measure represents openness as a ratio of school building area and the number of linear feet of walls enclosing the teaching areas. The openness quotient can be modified to include other structures which define the classroom perimeter, such as screens and furniture.

In summary, much of the previous research examining the effects of openness has been distinguished by inadequate measurement of both predictor and outcome variables. Recent studies, however, have attempted to address these problems by making a distinction between open education and open facilities, by treating openness as a continuous variable, and by evaluating other outcomes besides achievement (e.g., task persistence, frequency of nonsubstantive activities, and reported distractions). In addition, research needs to examine more carefully the concept of fit between users and educational settings and between programs and educational settings. Perhaps the reason why openness as an independent variable has demonstrated few clear effects is because some children are affected positively and others negatively, yielding a nonsignificant net change in behavior. As discussed in a later section of this chapter, research that takes into account individual differences and the instructional context of class activities may yield more definitive information on the impact of classroom design on student behavior and well-being.

Seating Position and Arrangement

Seating position in the classroom has been studied extensively since Sumley and Calhoun (1934) discovered that the distance between student and teacher was a significant factor in the child's ability to remember word groups. Since then, a number of studies have found that front-and-center row seating positions are significantly correlated with higher grades, more positive attitudes, and a higher degree of class participation for those students predisposed to speak in class (cf. Weinstein, 1979).

In one of the most extensive studies of seating position conducted to date, Adams and Biddle (1970) observed verbal interactions between students and their teachers in 32 classes at the primary and secondary levels. They found the highest amount of verbal interaction among those students sitting in desks in the front and center rows. They consequently labeled this area the "action zone." Adams and Biddle discovered that the targets of teacher-initiated conversation were overwhelmingly located in the action zone, which suggests that teachers may attend more to students in the front and center of the classroom. Delefes and Jackson (1972), studied fifth- and eighth-grade classes but did not find any differences in teacher-student interaction due to seating position. However, they did discover that teachers called on students located in the front more often than those seated in the back. Examining 14 elementary school classrooms, Schwebel and Cherlin (1972) found that students who were assigned seats in the front rows were more attentive and engaged in more task-relevant behavior than those students in other rows. When students were then randomly assigned seats, these differences disappeared. However, those students who moved forward received more favorable teacher ratings on attentiveness and likability than they received before changing positions. Students who moved from the front to the back of the classroom received less favorable teacher ratings.

While methodological differences may partly account for these conflicting findings, together these studies reveal an interesting connection between the environment and student reactions, namely, the teacher. Teachers' perceptions of student attentiveness and teacher-initiated conversation were associated with seating position. Additional research is needed to examine the causes of such phenomena as well as the consequences of these teacher practices on students, especially over time. The results of these investigations may have important implications for classroom practices regarding the frequency with which seating positions are changed during the school year. Students are very aware of the implications of seating position. MacPherson (1984) has shown that students see different areas of the classroom as providing varying opportunities for action, for control over their classmates and teachers, and for their academic accomplishments. Students tend to sit in areas of the classroom according to their goals and their perceptions of advantage and disadvantage.

Unlike the extensive research on seating position, that on seating arrangements is quite sparse. The traditional rows-and-columns seating arrangement is still common in many classrooms, although new arrangements such as horseshoe and clustered patterns are also quite popular. Winett, Battersby and Edwards (1975) investigated the effects of changing from a traditional row-and-column organization to a clustered seating arrangement. Examining academic and social behaviors of a sixth-grade classroom, they found no significant differences. However, their sample size was small, their time span for collecting baseline observations was quite limited, and their post-intervention observations were confounded with other academic interventions.

Further research needs to be undertaken, focusing on the effects of seating patterns at the grade school level and on the implications of students working in close proximity to their classmates. Potential effects include increased distraction, withdrawal as a form of privacy-seeking, cooperativeness among students, and aggressive behaviors. Bennett and Blundell (1983) studied the effect of different seating arrangements on the quantity and quality of work produced in reading, language, and mathematics among two classes of 10- and 11-year-old children. In both classes matched for size, age, and sex distribution, students spent the first two weeks in their normal classroom groups. The second two-week period was spent in rows before moving back into groups. They found that the quantity of work completed generally increased without sacrificing quality when children were seated in rows. A number of uncontrolled variables may have influenced these findings, however.

Windows

Advances in technology and construction have made the presence of windows an amenity in school design. Windowless schools are often the focus of heated debates in the community. Proponents mention freedom from excessive heat, glare, and distraction, and a decrease in vandalism, while opponents speak of the lack of visual access to the outside and claustrophobic reactions (Brown & Hult, 1967; Burts, 1961; Nimnicht, 1966). In a review of the research, Collins (1975) concluded that windowless classrooms had little impact on students. Demos, Davis, and

Zuwaylif (1967), for example, found no significant differences in achievement test scores, grade point averages, health records, or personality test results for fifth-grade students in two classrooms, with and without windows, respectively.

Larson (1965) conducted a 3-year longitudinal study of a school in which, for one year, the windows were removed. Performance and class behaviors of the same students were studied in settings with and without windows. He found no significant differences in school performance or overall absenteeism. A grade-by-grade analysis did reveal that kindergartners were more frequently absent from the windowless school, perhaps indicating that an adaptation process to windowless schools occurs after the first year in a windowless building. Unfortunately, in these studies the absence of random assignment of students to schools or classes and the covariation of other environmental features with the presence or absence of windows makes it difficult to draw firm conclusions about the effects of windows on behavior.

Attitude surveys of children in windowless schools reveal less consistent conclusions. The results of these surveys range from positive evaluations of windowless classrooms (Chambers, 1963), to evenly divided opinions (Tikkanen, 1970), to increased displeasure toward windowless classrooms as length of tenure in school increases (Demos, Davis, & Zuwaylif, 1967).

Secluded Study Space

Secluded study space for students is an occasional feature in school classrooms, either constructed by the original contractors, fabricated later by teachers and students, or provided by commercial school suppliers (e.g., cubby corners, hideaway cubes). Secluded study spaces are physically distinct areas, smaller in scale and size than the regular classroom, and intended to accommodate only a few students. They are physically separated from the rest of the classroom by either changes in floor level or by walls and partitions. Ahrentzen (1981) found such spaces to be particularly important to students. When asked where they would like to go when they really need to concentrate, 60 percent of students in elementary classes with such spaces mentioned them, in contrast to 11 percent of students in such classes reporting that they could concentrate at their desks. Unfortunately, the use of such spaces is often restricted by teachers. Environmental features thus may provide opportunities for optimal study, but institutional or class practices may negate these opportunities, possibly resulting in student frustration from attempts at coping in a less than optimal environment.

Weinstein (1977) used a quasi-experimental, time-series design to examine the effects of design changes in an open elementary classroom. Additional shelving and writing areas accessible to students, a small private area in the corner of the room, and clear boundary demarcations of specific study areas were added to the classroom. With these changes, Weinstein reported a more even distribution of students across the room, use of previously underutilized areas of the classroom, and an increase in the use of manipulative games and materials. She also found a decrease in the time spent by students "looking at people" in the reading area.

Climatic and Luminous Conditions

Temperature, humidity, and air movement all appear to have an effect on academic achievement and task performance. In general, higher levels of temperature and humidity are associated with decreased achievement, task performance and attention span, and greater discomfort, while cooler temperatures are related to increased comfort, activity, and productivity. For instance, Flatt (1975) studied high school students in a gymnasium situation. As the temperature in the gym increased, fitness and endurance fell. Ryd and Wyon (1970) studied third, fourth, and fifth grade Swedish students in a laboratory setting. Higher temperatures (27°C compared to 20°C) led to decreased performance on oral language tasks for these students. Wyon (1970) described a series of heat experiments with children that revealed decreases in simple task performance and comprehension at high (27°C to 30°C) compared to low (20°C) temperatures. These results held for 11- and 13-year-old students but not for 17-year-olds. Wyon (cited in King & Marans, 1979) also examined 40 Swedish 11-year-olds in a laboratory situation, looking at the effects of temperature and noise on two types of tasks, one needing a great deal of concentration, the other requiring very little. Noise conditions were at 65-70 dB or 85-90 dB; temperature varied from 20°C to 23.5°C to 27°C. Increased temperatures resulted in decreased performance on the task requiring a great deal of concentration but increased performance in the non-concentration task. There was no effect for noise.

In a series of studies of thermal conditions on elementary school children (Schoer & Shaffran, 1973), researchers had matched pairs of students perform various tasks under two controlled class conditions: (1) temperature varying from 21°C to 24°C, humidity varying from 35 to 61 percent, and air movement at 20 to 40 feet per minute; and (2) temperature at 22°C to 27°C, humidity at 26 to 48 percent, and air movement at 15 to 25 feet per minute. This latter condition was said to reflect the "typical" classroom condition. There were no differences found between the two groups in performing a simple task. Differences between the two groups, however, occurred on a more complex, conceptual task, with those students in the "typical" condition taking more time to complete the task and making more errors. Those students in the experimental condition also reported that they were more comfortable.

In England, Humphreys (1974) interviewed 48 elementary school teachers from six schools. These teachers reported that rain, wind, and cooler temperatures resulted in better attention, concentration, and activity among their students. Heated conditions were reported to be associated with decreased concentration, attention, and student activity. Humphreys later interviewed over 600 elementary school students. For these students discomfort was related to the change in temperature rather than to the absolute temperature itself. The greater the change in temperature, the more student complaints.

Unfortunately, most studies examining the effects of heat are undertaken in laboratory settings and not school settings (the Schoer and Shaffran studies were in a contrived classroom setting, students only using these rooms for two to eight weeks). Admittedly, undertaking research on temperature and humidity in natural settings is difficult when one considers uncontrollable fluctuations in temperature and regional differences. However, several outcome factors pertinent to the impact of temperature - absenteeism, student lethargy, amount of teacher time spent teaching, teacher satisfaction, active versus passive learning tasks - can only be examined in natural settings.

Little research has been undertaken examining lighting in school settings. Research by Mayron, Ott, Nations, and Mayron (1974) was conducted on approximately 100 first-grade students in four windowless classrooms in Florida. Two classes were equipped with cool white fluorescent lights; the other two had vita-lite (full spectrum) fluorescent lights with cathode elements wrapped to shield against X-rays. The fixtures were further shielded against electro-magnetic radiation. First-graders were randomly assigned to these classrooms. From observations conducted for six months, the researchers found less hyperactive behavior and greater discipline among students in the experimental classes. There were no differences in absenteeism or visits to the nurse. Although confounds exist with teaching style and discipline, this study reveals a need to examine whether certain lighting and/or radiation conditions are stress-inducing environmental features for students.

Noise

Although the research literature on noise and stress is voluminous (see Cohen & Weinstein, 1981), there has been little research conducted on the impacts of normally-occurring noise in schools. In order to understand noise in educational settings, three dimensions are particularly relevant: the duration of exposure (long or short term) to the stimulus, the nature of the noise, and the threat of potential noise occurrences.

In examining short-term exposure to noise originating within the school, Slater (1968) compared seventh-graders' performance on a standardized reading test in (1) a quiet (45 to 55 dB), isolated classroom; (2) in an average (55 to 77 dB) classroom near hallways and other classes; and (3) in an extremely noisy classroom (75 to 90 dB) near hallways and other classes and supplemented with noise from outside lawn equipment, tape recordings from neighboring classes, and free-play in the hallways. No effects on speed and accuracy of performance were found under the different noise conditions. Weinstein and Weinstein (1979) compared reading performance of fourth-graders under quiet (47 dB) and normal (60 dB) noise conditions in classrooms. They found no impairments in task performance between the two groups although they did find a marginally significant decrease in speed of performance in the noisier setting.

Investigators have also examined long-term exposure to noise originating from outside the classroom. Kyzar (1977) studied the amount of traffic noise near various classrooms and discovered a decrease in teaching time where noise from the street was louder. Bronzaft and McCarthy (1975) examined the reading scores of elementary school students who were located near an elevated train. The scores of children on the noisy side of the building were significantly lower than those students on the quieter sides. This decrement could occur as the result of (1) students on the noisy side being unable to hear the teacher, resulting in decreased interaction and communication; (2) a decrease in instruction time on the noisy side, similar to findings of the Kyzar study; and (3) students in noisier settings filtering out relevant and irrelevant sounds, resulting in poor auditory discrimination and, hence, reading ability (cf. Cohen, Glass & Singer, 1973).

Cohen, Evans, Krantz, and Stokols (1980) examined the effects of long-term noise exposure on third- and fourth-graders from schools in the air corridor of Los Angeles International Airport and matched, control schools. There were no significant differences on tests of auditory discrimination, mathematics achievement, or reading achievement. However, students in schools under the air corridor displayed greater distractibility with increased years of exposure to noise. Additionally, these students manifested "learned helplessness" or a lack of persistence on a puzzle task and had significantly higher blood pressures. The use of multiple outcome measures (social, cognitive, and physiological) in this study displays the wide range of effects of noise on students' behaviors. These investigators also found evidence that the school and home domains of the children are interdependent: children attending noisy schools and living in the noisiest residential areas were more likely to give up on complex puzzle tasks than those children from relatively quieter home environments.

Aside from the duration of exposure to noise, another dimension of noise is the nature or content of the noise. Brunetti (1972) found that students in both elementary and high schools (both traditional and open space) reported that they were more often distracted by social conversation than task-oriented conversation or general noise. Students in the study also reported less distraction during high school lab activities although decibel levels of lab and non-lab activities were similar. In considering multiple stressors, Brunetti hypothesized that crowded conditions would amplify the effects of aural distraction, particularly in terms of distraction from social conversation. In the schools he examined, density differed in various areas while decibel levels remained the same. Students in these high density areas reported more distractions than those in low density areas with the same decibel levels. These results suggest that both individual and multiple combinations of environmental stimuli in classrooms can affect student activities and performance.

Fitzroy and Reid (1963) investigated acoustical satisfaction in 37 open space schools. They found that high levels of ambient sound were acceptable to teachers and students, although low reverberant sounds were the most acceptable. The conclusions they drew are similar to those of Brunetti: that for intruding noise to be acceptable it ought to be of a general nature without easily identifiable components.

That noise in schools may now be "acceptable" to teachers and students has caused growing concern about the impacts of adapting to such noise. Critics warn about the effects of "tuning out" to stimulus overload (Dubos, 1965; Toffler, 1970) although no such studies in schools have been undertaken. However, the threat of potential noise can also produce a stressful situation (Lazarus, 1966), leading to a change in one's behavior. Instead of "tuning out," teachers and students may adapt to potential noise by inhibiting and restricting activities that would create noise and disturbance. Kyzar (1971), in studying teachers' attitudes towards noise in open and traditional schools, found that teachers in open space schools selected activities that were "quiet-producing". Gump and Good (1976) report similar responses by teachers in open space schools. Teachers reported two dimensions of noise: noise that actually occurred and efforts to prevent noise. Teachers in open classrooms did not find the first type of noise much of a problem. However, half of the teachers mentioned efforts they used to prevent noise that restricted or eliminated certain activities. In a study of both traditional and open design elementary schools, Ahrentzen (1981) found that those teachers who restricted certain class activities for fear of making noise and disturbing others were in classrooms with more demountable, nonstructural walls.

Thus, teachers' coping responses to potential noise may produce behaviors or conditions detrimental to students. The necessity for teachers to restrict or eliminate various noise-producing activities (e.g., group discussions) may be particularly impairing for younger students who, because of their lack of control or choice, cannot oppose the teacher and who need to learn through active interaction with their environment (Piaget, 1952; Leonard, 1968). Unfortunately, many of the activities in which students take an active participant role in learning or work actively together as a group are the activities teachers eliminate in trying to cope with potential noise. Pen-and-paper tasks and quiet reading may become the students' primary activities. In a naturalistic observation study, Gump (1978) found that 36 percent of students' learning time in schools was spent in pen-and-paper tasks and 37 percent spent in directed recitation (i.e., teacher questioning, then student answering). Where teachers feel so threatened by the potential of noise that they change their curriculum and teaching format, these passive modes of learning may become increasingly the primary teaching mode.

Aesthetic Amenities

Schools today typically contain the standard provisions of desks, chairs, and chalkboards, but they often vary in other classroom amenities such as decorations, types of furniture, and separate study spaces. Laboratory studies of the aesthetic appeal of surroundings were undertaken by Mintz (1956) and Maslow and Mintz (1956). These early studies revealed that adults working in "ugly" environments felt more discontent, fatigue, monotony, and a greater desire to leave than those working in more "beautiful" workspaces. In an elementary school setting, Santrock (1976) demonstrated that the "affective" quality of a setting can influence students' task persistence. Approximately 100 students were taken individually to rooms which were decorated with "happy," "sad," or neutral posters. Those students in the "happy" room persisted longer at a motor task than those in rooms with neutral or sad posters. As Weinstein (1979) points out, these findings question prevailing practices characterizing the persistence and motivations of students as enduring, personal traits. Situational factors such as room design may have a greater impact on student involvement than is generally recognized. Other aesthetic features that are feasible for future study include: decorations of children's artwork versus commercial or teacher-constructed decorations (a form of student personalization); bright colors versus dark or muted colors; and carpeting and soft furniture versus tile floors and exclusively hard furniture (Sommer & Olsen, 1980).

Limitations of Past Research

The research on school environments reviewed here is limited in several respects. Many studies overemphasize achievement as an outcome criteria. Most ignore aftereffects and mediators of stress. Sample biases plague much of the work. Important predictor variables have been problematic, underutilized, or ignored. Given these methodological and conceptual limitations, an alternative research paradigm that addresses some of these problems is proposed for the present study. Although methodological problems with many studies abound (see Weinstein, 1979, for a critique), the focus of the following discussion is on conceptual and theoretical problems in school environment studies.

Methodological Limitations

Methodological difficulties of classroom studies include several sample biases. As with most field research, sample selection bias and the inability to randomize pose threats to internal validity. In addition, small sample sizes jeopardize the conclusions drawn from many studies. Comparisons are often made between only two classrooms or two schools that vary on one particular physical dimension. With only one comparison group there is a greater chance that differences observed are due to nonequivalence between groups. Two studies mentioned previously employing large samples, Gron et al. (cited in King & Marans, 1979) and the Metropolitan Toronto School Board (1972), found no main effects for achievement by open versus traditional school design while several studies with smaller samples yielded mixed results.

In addition to subject selection bias, several other methodological problems plague many field studies of school design and behavior. Reactivity of measures is a problem, particularly when teachers and students can "guess" the desired outcomes of a particular study. Additionally, many studies of classroom design have not utilized control groups, relying on changes in behavior measured pre- and post-intervention. The importance of control groups in school settings, even when non-equivalent, is discussed in detail by Evans and Lovell (1979).

Statistical problems are also apparent. Many statistical procedures assume that observations are independent, in which case the unit of analysis should more appropriately be the individual rather than the class. Another problem is overall experiment error rate. Type I errors, the probability of falsely rejecting the null hypothesis, inflate when multiple dependent measures are analyzed. Appropriate multivariate techniques have generally not been used in previous school environment research.

Conceptual Problems

Much of the prior research, particularly that examining noise and classroom openness, relies solely on achievement or task performance as outcome measures. This is problematic, first, because school achievement depends on a great number of factors other than the physical setting. As such, it is naive to assume that a change in the physical environment could directly affect achievement if other influencing factors (e.g., motivation, teacher expectations, ability) remain the same. Franck (1984) describes four major weaknesses of a determinist perspective: (1) exaggerating the influence of the physical environment by ignoring or underestimating the influence of other factors; (2) assuming that the physical environment has only direct effects on behavior; (3) portraying people as passive in the environment-behavior relationship by ignoring the role of human choice and goals; and (4) always assuming that the environment is a given and immutable entity and neglecting the processes of creating and modifying environments. Second, large individual differences in student aptitude or intelligence may obscure significance tests examining the influence of design factors on standardized tests. This is particularly true when between-groups study designs are employed, as is often the case in classroom design research. Third, as mentioned previously, if no difference in achievement scores is found, one cannot assume students encounter no difficulties in maintaining such achievement standings. Decreased speed of performance, passive interest in school work, distractibility, and aftereffects occurring in other settings are undesirable conditions that students may have to endure to maintain achievement status in less than optimal school environments.

Fourth, the sole reliance on achievement tests ignores direct impacts the physical environment may have on behavior other than intellectual performance. Attitudes, health, spatial behavior, satisfaction and comfort, social behavior, and participation have largely been ignored in studies of school settings. As discussed by Weinstein (1979), intellectual achievement, while critical, is not the sole criterion of success in school. Although traditional perspectives view achievement variables as the ultimate ends of schooling, recent critics and researchers (Sommer, 1973; Moos, 1979) have begun to doubt the practicality and adequacy of that perspective. In reviewing the effectiveness of schooling, Averch (1974) found that socialization and the development of creativity and self-reliance were among the most important functions of schooling. Recent evidence (see Moos, 1979) shows low relationships between cognitive achievement, as measured by grades and standardized tests, and later success. Epstein and McPartland (1975) found that positive reactions to school increase the likelihood that students will stay in school, develop a lasting commitment to learning, and use the institution to advantage.

Another limitation of previous research is the lack of attention paid to aftereffects of stress. Harmful effects of stressors may go undetected because they manifest themselves when coping efforts stop or fail (Cohen, 1980). During experimental noise conditions subjects may show no task performance deficits, yet deficits are noted during subsequent quiet testing conditions (Cohen & Weinstein, 1981). This failure to carefully consider aftereffects is common to nearly all previous classroom studies. One exception is the study by Cohen et al. (1980) where children from noisy schools were tested under quiet conditions. Evidence of aftereffects in the forms of distractibility and decreased task persistence were found. Aftereffects may occur in the cafeteria, the playground, or at home. The isolation of the school as the only observed setting ignores the possible carry-over of behaviors or aftereffects across settings.

Time is another important variable neglected by past research. Many stressors produce cumulative effects from long-term exposure (Dubos, 1965) that may not be observed in "one-shot" experimental designs. In two studies, length of exposure was associated with decreasing satisfaction in windowless classrooms (Demos, 1965) and with increasing distractibility, decreasing task persistence, and increasing blood pressure in noisy classrooms (Cohen et al., 1980). Additionally, few classroom studies have examined how changes in the physical environment impact student behaviors. Three studies that are exceptions observed behavioral outcomes of systematic changes in seating arrangement (Schwebel & Cherlin, 1972), traffic flow (Evans & Lovell, 1979), and study area boundaries (Weinstein, 1977).

Few classroom studies have investigated mediators of stress. Throughout the stress literature, control, predictability, and adaptation have been observed to mediate the negative impact of most stressors (Baum, Singer & Baum, 1981). As mentioned previously, lack of control and choice in the classroom is a primary feature of elementary and secondary schools (Jackson, 1968). However, within schools there is some diversity. Basic options like student choice of seats, furniture arrangement, ability to leave the room to study, etc. are available in some classes and not in others. The relative availability of such choices may obscure other environmental influences. Unfortunately, situational variables tapping individual's control and predictability of stressors have not been explored. Besides control and choice, a number of other mediating variables that may have importance for stress in classroom environments have not been studied. For instance, teachers' attitudes toward the classroom has received only scant attention. Studies of seating position have noted the relation between environmental conditions and teachers' expectations on students' participation and interaction. Kyzar (1971), Gump and Good (1976), and Ahrentzen (1981) report that teachers in open space classrooms restricted activities for fear of creating noise to nearby classrooms. These behavior restrictions could consequently create stress not only for teachers but for students. Another neglected dimension is teacher "burn-out." In some instances, this problem may be related to the misfit between a teacher's instructional program and the physical environment. Is coping with inadequate or unsatisfactory environmental conditions adding to the problem of stress or "burn-out," and what are its consequences for students? Failure to include dimensions of teacher satisfaction in the sociophysical context of the classroom may overlook important stress-inducing interactions between the teacher and the physical setting that are eventually reflected on students' behaviors.

A final set of limitations involve the independent variables in classroom research. In particular, the levels of some independent variables have not been adequately construed. As mentioned earlier, the open space-traditional dichotomy inadequately describes the continuum of openness-containment in school design today. Only two studies, Ross and Gump (1978) and Ahrentzen (1981), employ interval level measurement of this dimension. In another study on the effects of heat (Azer, 1972), experimental conditions varied by only 2.5°C in relatively high temperature (32.5°C versus 35°C) and no temperature effects for task performance were found. The use of inadequate levels of these variables may explain the insignificant or conflicting results obtained.

The open-traditional dimension suffers further from a construct validity problem. As noted earlier, openness has not been defined consistently across studies, and is rarely differentiated from educational philosophy. This confound may be the cause of discrepant findings among studies in this area.

Present Study: The Influence of Individual Differences and Environmental Factors on Stress Within Classroom Settings

A major reason for the lack of sufficient evidence on the effects of the classroom environment may be because individual characteristics of students have not been taken into account. That is, an interaction between individual differences and aspects of the classroom setting may exist, an interaction that heretofore has been largely ignored by research dealing with the physical environment of the school. Information from the environment is mediated by the individual, and his/her response will be determined by personal factors (e.g., arousal-seeking tendency) involved in that mediation process. The situationist orientation that runs through much of the classroom research to date fails to recognize that environmental effects are not unidimensional: *all* students do not require private spaces in classrooms, nor are *all* children distracted in open space classrooms.

The present study proposes that a person-environment interaction model of behavior be used to investigate the effects of classroom settings. According to this model, an individual is characterized by a reliable pattern of stable and changing behaviors across situations of different character (Endler, 1975). Inherent in this construct is the assumption that both personal and environmental aspects must be considered in any understanding of human behavior. Furthermore, the interaction of both aspects provides more explanatory power than is afforded from a separate examination of either person or setting variables alone. Endler (1975) also describes the necessity of employing an interaction framework in behavioral research:

> Asking whether behavioral variance is due to either situations or to persons, or how much variation is contributed by persons and how much by situations (an additive approach) is analogous to asking whether air or blood is more essential to life or asking to define the area of a rectangle in terms of length or width. . . . The appropriate and logical question is "How do individual differences and situations interact in evolving behavior?" (p. 16)

The interaction model of behavior can be extended to assume that persons and environments can interact at an optimal level; such a perspective provides a theoretical explanation that meshes with the current transactional models of stress and coping (Lazarus & Folkman, 1984). Less than optimal matches between intra-individual and environmental factors are identified during the appraisal of stressful events (see Figure 1) and may contribute to an individual's reduced capacity to cope with environmental demands. If we assume that a person has a limited amount of energy (whether it be biological or psychological in nature) and that prolonged coping with stressful episodes depletes this energy supply, then person-environment mismatches will be expected to drain one's adaptive reserves at a faster rate. Stress can be predicted to occur whenever persons find themselves in situations where the opportunities and demands do not match the individual's expectations, needs, or abilities (French, Rodgers & Cobb, 1974). That is, one can imagine persons and environments as pieces of a large jigsaw puzzle: pieces that fit together form a stable balance whereas mismatching pieces that are forced together create disharmony. According to this "person-environment fit" model, a high level of "fit" would be accompanied by high levels of satisfaction, performance, goal attainment, and health; conversely, person-environment mismatches would be accompanied by dissatisfaction, goal blockage, performance and health deficits, and stress (French, Rodgers & Cobb, 1974; Jahoda, 1961; Pervin, 1968).

Recently, Cohen et al. (1986) have distinguished an interactionist theory from a contextual theory, with the latter focusing on situational rather than intrapersonal moderators of environment-behavior relationships. Contextual research incorporates supplemental predictor variables drawn from the immediate situation (e.g.,

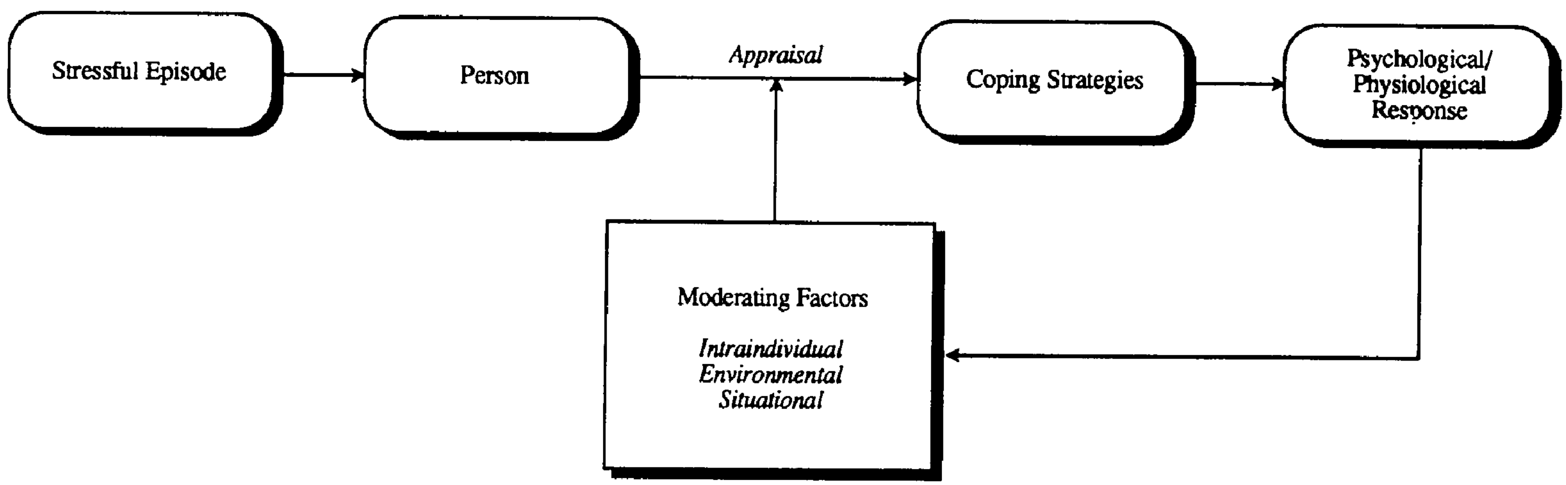

Figure 1. A transactional model of stress.

other conditions of the school environment such as classroom density) or more distant events (e.g., noise levels at the child's home) that presumably qualify the relationship between the target predictor and outcome variables (e.g., school noise and blood pressure levels).

Though an interactionist approach to behavior has long been advocated in psychological theory (cf. Brunswik, 1943; Hull, 1943; Lewin, 1951; Tolman, 1938), research in the area (e.g., Pervin, 1968; Wechsler & Pugh, 1967) and new theoretical formulations (e.g., French, Rodgers & Cobb, 1974; Hunt & Sullivan, 1974) have emerged relatively recently. In the educational arena, a body of research that has become known as aptitude-treatment interaction (ATI) reflects an interactionist perspective. ATI examines the notion that particular children may enjoy and perform well in classrooms which are consistent with their abilities, learning styles, needs, interests, motives, and/or values. Educational psychologists have argued that no single instructional process provides all students with optimal learning (Cronbach, 1957, 1967; Glaser, 1967). For example, a comprehensive study by McKeachie (1961) found that students with strong achievement needs performed best in classrooms which were highly organized and structured and that those with high affiliation needs did best in classes with "warm teachers." Grimes and Allinsmith (1961) reported some similar results concerning anxiety: highly anxious (and compulsive) children progressed better in reading with a structured (phonic) treatment than with an unstructured (whole word) treatment. Dowaliby and Schumer (1973) found that anxious students learned best in "teacher-centered" rather than in "student-centered" classes. Reviews of ATI research can be found in Cronbach and Snow (1977) and Berliner and Cohen (1973). Much of this work has employed college students as subjects.

Though admirable, aptitude-treatment research to date is noted by several limitations: (1) "treatment" most often refers to a teaching method or the organizational climate of the classroom; the physical environment is largely ignored; (2) when the physical classroom setting is accounted for, it is described as either "open" or "traditional" based on a priori operational definitions; and (3) only a very small number of classrooms usually are employed.

The proposed research attempts to build on these studies by integrating elements of student characteristics, classroom organization and social climate, and physical setting features into a framework for studying school settings and stress. The primary focus of this framework is not the separate elements but the interaction between environmental and personal factors.

Environmental Factors

Like all settings, the elementary school classroom is composed of both physical and social elements. Additionally, because these two domains are part of a system, each can influence educational outcomes directly, as well as indirectly, through the other domain (Moos, 1979). For example, a classroom may have secluded study spaces (physical attribute) yet their use may be governed by the teacher (social attribute); thus, any study of the effects of privacy areas on educational outcome would have to consider both domains. Recognizing this, the present study examines both physical design and psychosocial dimensions of the classroom setting. The physical features included in this study were chosen because of their relevance to the classroom research literature: density, openness of perimeter, amount of window area, arrangement of furnishings, and the presence or absence or secluded study space. Interval-level measures of openness and window area are used, departing from the more conventional a priori definitions used in prior research, an approach criticized in previous sections. In addition, it has been argued on theoretical grounds that density is related to outcome variables (especially task performance) in a curvilinear manner, both overload and underload being less favorable than moderate levels (cf. Evans, 1978). Empirical studies in school settings provide some support for this view (e.g., Shapiro, 1975). Thus, a curvilinear interaction between density and individual differences was included in the predictive models tested in the present study.

All of the psychosocial elements examined in this study originate from factors used by Moos (1979) to characterize the social climate of a classroom: student involvement, affiliation, teacher support, task orientation, competition, order and organization, rule clarity, teacher control, and innovation. According to Moos, these elements make up three social climate dimensions: relationship, personal growth, and system maintenance and change.

Individual Differences

While numerous personal characteristics no doubt influence the amount f stress students experience, those in this study were selected because they are likely to interact with the previously-mentioned environmental attributes. Persons differ in the amount of stimuli desired from the environment: some people prefer unpredictable lifestyles whereas others are attracted to the more routine. This difference in sensation- or arousal-seeking tendency, it is believed, will interact with the setting the person is in and will result in stress if there is incongruence. For example, classrooms with many visual distractions (e.g., open classrooms) may be perceived as stressful to a student who is low in sensation-seeking tendency and not stressful to a student high in sensation-seeking tendency.

Medical research has characterized a behavior pattern known as Type A that is related to coronary artery and heart disease. This pattern is manifested by extreme competitiveness, a strong sense of time urgency, impatience, easily-aroused anger, and aggression (Friedman & Rosenman, 1974). In contrast, Type B persons are noted by the absence of Type A characteristics. It has been suggested that the health implications of Type A behavior in adults can be traced back to childhood experiences (Matthews & Angulo, 1980). Type A adults may have had a similar behavior pattern as children. Because of this, and due to the prevalence of the health problems associated with pattern A, this attribute is included in the present study. It is hypothesized that this characteristic will interact with classroom settings: a Type A child may not immediately experience stress in a classroom promoting such behavior (e.g., competition, time urgency, aggression); yet in the long-run, promotion of this behavior pattern may prove to be highly stressful (e.g., heart disease).

Outcome Measures

It is hypothesized that coronary-prone behavior pattern and arousal-seeking tendency will interact with classroom design factors to moderate relations between stressful events and behaviors symptomatic of dysfunctional coping. Person-environment mismatches are assumed to result in stress, and may be manifested by psychological, behavioral, and health deficits. Thus, attitudinal indicators such as satisfaction with the classroom setting, commitment to school work, and cooperativeness, and behavioral indicators such as absenteeism, disruptive behavior, task inattention, and fidgeting are included in this study. For example, absenteeism, task inattention, fidgeting behaviors, and level of cooperativeness are presumed here to be secondary, or indirect, effects of one's exposure to a stressor in that they occur because of the coping process rather than because of the stressor itself (cf. Cohen, 1980; Cohen, Evans, Stokols, & Krantz, 1986; DuBos, 1965; Glass & Singer, 1972). For students in the study, these variables represent some of the behavioral and psychological costs of adapting to stressors. As discussed earlier, relations between individual differences and classroom design factors may moderate the efficacy of the adaptive process. Certain person-environment relations (e.g., an unsuitable match between a student's needs and the resources available in the classroom) may contribute to an individual's reduced capacity to cope with environmental demands. Thus, if we assume that a person has a limited amount of energy (whether it be biological or psychological in nature) and that prolonged coping with stressful episodes depletes this energy supply, then person-environment mismatches will be expected to drain one's adaptive reserves at a faster rate. This extension of the adaptive cost hypothesis (Selye, 1956) provided the basis for the prediction of interaction effects on absenteeism, task inattention, fidgeting, and cooperativeness. Others have suggested similar measures to represent the secondary effects that can occur over the course of one's exposure to a stressor (e.g., Cohen, 1978; Deutsch, 1964; Epstein & Karlin, 1975).

Conventional achievement measures such as grades and task performance have been omitted from this study because of the criticisms surrounding them (see previous sections). Instead, questioning and participatory behaviors are included. Increased student participation would indicate good person-classroom congruence; increased content questioning over process questioning would indicate lower distractibility (Evans & Lovell, 1979) and, hence, a higher level of fit.

METHODS

Respondents

Sixteen fourth, fifth, and sixth grade teachers (three male and 13 female) representing six elementary schools in Southern California volunteered to take part in this study.[1] These volunteers were members of a much larger pool of principals and teachers who were contacted regarding their interest in participating. The majority of them declined because of the perceived amount of time teachers and students would be required to invest in the study. Others preferred not to be involved due to competing requests from other research projects, while a number of principals questioned the appropriateness of using young students as research subjects. Others contacted declined to state a reason for refusing to participate. Although specific demographic information was not obtained for these schools, there is no reason to suspect that they differ systematically from those schools participating in the study.[2]

Of the 16 teachers, four taught fourth grade, six taught fifth grade, three taught sixth grade, two a combination of fourth and fifth grades, and one a combination of fifth and sixth grades. Experience teaching in primary schools ranged from one to 18 years, with eight years the median. Only two teachers reported that the physical arrangement of their present classrooms differed significantly from other classrooms they had taught in.

Joining their teachers in this study were 136 students (62 male and 74 female) randomly selected from a pool of 255 whose parents had consented to their participation. (The role played by the remaining 119 students is described in a following section.) Thirty-nine of these students were drawn from the fourth grade, 74 from the fifth grade, and 23 from the sixth grade. Their ages ranged from 8 to 13, with 73 percent of the students being age 10 or 11. The majority (62.7 percent) of the students were Caucasian, while 18.7 percent were Hispanic, 17.2 percent were Asian, and 1.5 percent were Black. (According to 1980 Census data, the following demographics were reported for the geographical area in which the schools are located: Caucasian, 78.4 percent; Hispanic, 14.8 percent; Asian and Pacific Islander, 4.7 percent; Black, 1.2 percent; Native American, 0.7 percent; and other races, 0.2 percent. Thus, at least with respect to racial composition, our sample is representative of the community at-large.) Nearly 76 percent of the students reported that they had attended their current school the previous year. Based on assessments from the teachers, the majority of classes included in this study contained students of average to above average ability level.

Classroom Settings

Since one of the primary objectives of this study is to investigate the effectiveness of various physical dimensions of classroom settings, it was imperative that classrooms recruited for the study vary among the physical characteristics of interest (such as degree of enclosure, type of furniture arrangement, and amount of window area). Unfortunately, since this study was conducted in naturalistic settings and relied on the participation of volunteers, physical variability was beyond the control of the investigator. Fortunately, as the following discussion illustrates, the 16 participating classrooms did provide a range of physical features. Schematic floor plans of two of the classrooms used in this study are shown in Figures 2 and 3.

Spatial Characteristics

Class enrollment ranged from 23 to 34 students, with a mean of 29 students per class.[3] The 16 classrooms ranged in size from 594 to 1,599 net square feet, with 979 square feet as the mean. Average ceiling height ranged from eight to 15 feet, with a mean of 10.5 feet. Classroom density, or the amount of space

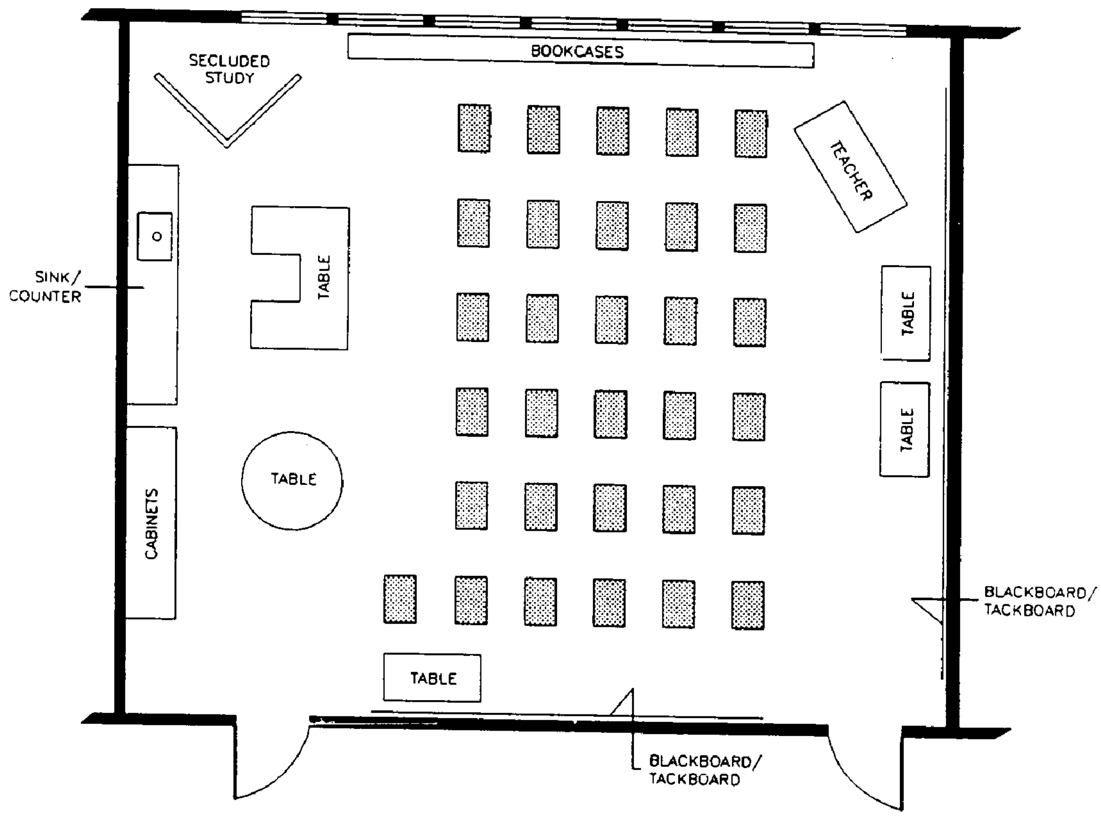

Figure 2. Floor plan of Classroom 14. As shown, 100 percent of the perimeter is comprised of permanent walls, desks are arranged in rows, and there is a secluded study area within the classroom. The density is approximately 31 square feet per student.

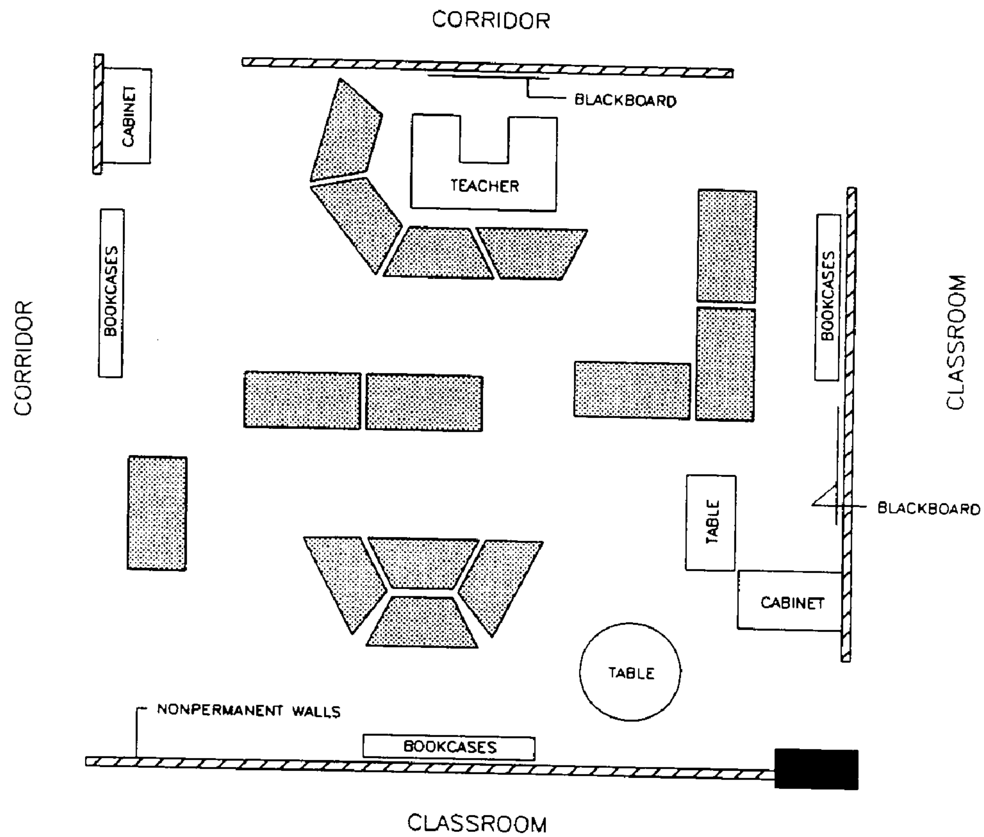

Figure 3. Floor plan of Classroom 16. As shown, the classroom is defined by nonpermanent walls, with about 40 percent of the perimeter comprised of open space. Workstations are arranged in clusters and the density is approximately 32 square feet per student.

allowed each student, ranged from 23 to 64 square feet per student, with an average of 34 square feet, and 239 to 959 cubic feet per student, with 365 cubic feet as the mean.

Furniture occupied between 17 and 33 percent of the floor space, with a mean of 25 percent. In ten of the classrooms, students worked primarily at tables, with two or more students sharing a table. Students sat at individual desks in three of the classrooms, while the remaining three classrooms contained both tables and individual desks. Student workstations were arranged in rows in nine of the classrooms, while six classrooms assembled stations in clusters; one classroom had both row and cluster arrangements. For these classrooms the number of stations per cluster varied between six and nine, with seven being the mean.

Perimeter Structures

Following a methodology employed by Ahrentzen (1980), the perimeter of each classroom was measured in terms of the length of full-height permanent walls, full-height nonpermanent walls, variable height walls, and open perimeter space. Full height permanent walls were either load-bearing or non-structural, and were generally constructed of masonry or gypsum board applied to a wood or metal frame. Full height nonpermanent walls, on the other hand, were designed to be demountable or moved along tracks; wall sections were constructed of much lighter materials and usually were covered with fabric or tackable surfaces. Variable height walls were commonly free-standing partitions between four and seven feet tall; these elements could be moved with relative ease. Open perimeter space was that part of the classroom perimeter not occupied by walls of any kind. (Doorways were generally integrated into permanent walls and were not included as open perimeter space.) Full-height permanent walls varied between zero to 100 percent of the classroom perimeter, with an average of 54 percent. Full-height nonpermanent walls ranged from zero to 65 percent, the mean being 21 percent.

Percentage of variable height walls varied from zero to 13 percent, with a mean of 2.5 percent. Open perimeter space ranged from zero to 57.5 percent of the perimeter, 23 percent being the mean.

Ten of the classrooms had conventional doors; students from the remaining six classrooms entered and exited through open perimeter space. (Inter-classroom circulation through open perimeter space remained in three of the ten classrooms with doors.) In an apparent effort to increase the degree of enclosure or to demarcate the edge of the classroom, furniture was often placed along the open perimeter. These "erected barriers" (Ahrentzen, 1980) ranged from zero to 70 percent of the open perimeter space, with the mean being 39 percent.

Classroom Amenities

Thirteen of the 16 classrooms had windows which looked out to the outdoors. Window area for these classrooms ranged from 13 to 252 square feet, with a mean of 101 square feet. Blackboard area within the classroom varied from 33 to 115 square feet, with an average of 76 square feet. Thirteen of the classrooms had carpeting throughout, one classroom had carpeting in some areas, and two classrooms had no carpeting. Only two classrooms contained "soft" furnishings such as large pillows or beanbag chairs. The presence of living things (small animals or plants, for example) was absent in seven of the classrooms; the number of living things in the remaining classrooms ranged between one and five, with one object being the mean.

Secluded study space was available within four of the classrooms; three other classes had access to secluded study space located outside of but adjacent to the classroom. Secluded study spaces were defined as discrete areas where students could go and work apart from the rest of the class. Such spaces were physically distinct from the main classroom and were intended to accommodate only a few students simultaneously. Secluded study areas included all or some of the following: permanent or temporary partitions separating the area from the regular classroom; different floor elevations; and the space and its furnishings scaled to correspond to the dimensions of young children. Areas of the classroom where students could achieve some degree of isolation but that did not have these physical distinctions were not considered secluded study spaces.

Art work, completed assignments, and other work produced by students ranged from zero to 90 percent of all material displayed on classroom walls, with 60 percent being the mean. Displays produced by the teacher, or made commercially, ranged between ten to 100 percent of all displayed material, with a mean of 40 percent.

Procedure

Initial contact was made with six superintendents, each representing a distinct school district in Southern California. The number of elementary schools within each district ranged from ten to 24. The objectives of the study were explained and in all cases consent was given to approach school principals with the intention of recruiting them for the project; in some cases, permission was granted only after a formal presentation was made before the school board. Fifty-four principals were contacted regarding their interest in participating; six eventually agreed. As mentioned previously, several reasons for not participating were expressed: the perceived time commitment, competing obligations, and uncertainties about the appropriateness of using students as research subjects.

Principals were informed that the researchers wanted to conduct interviews with students and observe activities within classrooms. With the assistance of the six principals, interested fourth, fifth, and sixth grade teachers were identified; the desirability of recruiting teachers from classrooms that had different design features was understood. The research procedures were described to them and the measurement instruments were made available for their inspection. At no time, however, were teachers informed of specific hypotheses being investigated in the study.

Teachers who volunteered to participate in the study were asked to distribute parental consent forms to their students approximately three days before the arrival of the research team, and to explain to them that students from the University who were interested in improving the design of schools would be coming to look at their classroom and to get their reactions to it. The confidentiality of information collected from both teachers and students was made explicit. Of the 462 parental consent forms distributed, 278 forms approving of their child's participation were returned, resulting in an average response rate of 60 percent.[4] (Response rates for individual classrooms ranged from 39 to 92 percent.)

Students whose parents consented to their taking part in the study were randomly assigned to one of two interview groups. Students in the first group ($N = 136$ and hereafter referred to as the "target" students) individually were asked a number of questions about their personal classroom experience; satisfaction with the class and commitment to school work; preferences for competitive and cooperative behavior; and attitudes and opinions about several other topics. Students in the second group ($N = 119$) were clustered by classroom and questioned en masse rather than individually; queries to these students focused on their perceptions of the socioecological qualities of their classrooms, including such concepts as rule clarity, task orientation, and teacher support. The intention behind this methodology was to define the classroom environment in terms of the shared perceptions of the students within that environment, rather than rely on the ratings of outside observers. This phenomenological approach, in addition to characterizing the classroom from the viewpoint of the actual participants, reveals information about the setting's deep-rooted attributes in a way that observational methods cannot (Moos, 1979). Moreover, usage of the subjective impressions of individuals other than the target students drastically reduces the probability of spurious correlations resulting from both the independent variables (e.g., classroom rule clarity) and the dependent variables (e.g., student satisfaction) emanating from the same method and from the same individual.[5]

The interviews were preceded by unobtrusive observation of the target students within their respective classroom settings. Conducting the observational sequences prior to the individual interviews was intended to prevent the target students from suspecting that they individually were being observed. Behaviors observed included participation in class activities, social interactions, disruptive actions, and other behaviors. These are described in more detail below.

A questionnaire was given to each teacher with a request that it be mailed back to the investigator. After a few days, follow-up calls were made to those teachers who had yet to respond; 14 of the 16 teachers (87.5 percent) ultimately returned completed surveys. Teachers were asked to respond to questions about their teaching methods and their opinions about a variety of educational issues. In addition, the questionnaire contained a number of items about the target students, inviting teachers to rate each student in terms of various behaviors.

All student interviews and observations were made by a team of 14 trained researchers (13 female and 1 male) during April and May of the 1980-81 school year.[6] The investigators returned to each classroom after classes had disbanded, usually at the end of the school day, and collected information about the physical design of the classroom, including measurements of spatial characteristics, perimeter structures, and amenities. Additional details on procedures employed in this study are provided in the following sections.

Measures

Data were collected through student interviews, behavioral observation of students in the classroom, teacher questionnaires, and detailed surveys of the physical classroom setting. Although this paper reports findings based upon a selected subset of the information collected, the following sections contain complete descriptions of the instruments used in this study.

Target Student Interviews

A preliminary questionnaire was pretested with fifth grade students who were not part of the study.[7] Following revision, interviewers were trained in how to administer the instrument, beginning with an overview of the research objectives and an orientation to interviewing technique.[8] The trainees practiced mock interviews with each other in the presence of an experienced investigator before receiving an opportunity to train with a group of pilot sixth grade students who were not involved in the study. Only after successful completion of the training course were interviewers allowed to administer the questionnaire in the field.

The interviews were conducted with individual target students out of the classroom and during recess or some other "free period" when students were allowed to work on anything they chose. Students were assured that the questionnaire was not a test and that their teacher would not see their responses. The questionnaire (Appendix A) consisted largely of four-point interval scales and questions requiring a yes-no response. Instructions and an example of a four-point scale were read to the student prior to beginning. For many of the items, small cards printed with the various response choices were shown to help the children remember the choices as well as to provide them with a visual scale of response magnitude. The students were free to interrupt the interviewer at any time in order to ask questions. Interviews ranged from ten to 33 minutes, with 18 minutes being the average.

The questionnaire consisted of approximately 85 items pertaining to the student's prior classroom experience, satisfaction with school life and commitment to classwork, achievement motivation, attitudes toward cooperation and competition, arousal-seeking tendency, and locus of control. During the interview, persistence on a difficult task was measured by giving students a cognitive exercise to complete. In addition, demographic information (such as the student's age, race, gender, and number of siblings) was requested.

Prior Classroom Experience. According to social-learning theory (Rotter, 1954), behavior is determined by the expectancy that one's behavior will lead to the attainment of the desired goal, and expectancy is determined by previous experience in similar situations. Student expectations, and thus their behavior, in the classroom are influenced by the amount of past experience within comparable classrooms. If students had attended a different school the previous year, they were asked to indicate how the design of their present classroom differed from their last one. Sample items are:

Did your classroom in the other school have soft furniture to sit on, like pillows, beanbags, or sofas? *(Yes/No)*

Did your classroom in the other school have spaces where you could read or work without being bothered by other students? *(Yes/No)*

Classroom Satisfaction. Students' perceived quality of life in the classroom was assessed with 17 yes-no and multiple-choice items. Consistent with the view that student behavior must be examined in the context of a multidimensional educational setting, the items touched upon several indices of classroom quality including general reactions to school, interest in classwork, opinions about the physical arrangement of the classroom, ability to escape unwanted distractions, and feelings toward the teacher and classmates. Example items include:

Do you sometimes have to ignore people in your class so you can get your work done? *(Yes/No)*

In my class I get so interested in an assignment or project that I don't want to stop work. *(Always/Often/Seldom/Never)*

In my classroom, I think there should be (1) more activity areas, (2) fewer activity areas, or (3) the same number of activity areas.

Cronbach's alpha (Cronbach, 1951) computed for the 17 items was .65 which, in view of the number of scale items and the diversity of concepts being measured, indicates a moderate level of reliability.[9]

Achievement Motivation. Four items in the interview were used to measure the strength of students' achievement motivation. This forced-choice inventory was modeled after the longer California Achievement Scale (CAS) which was developed to assess achievement concerns in younger children (Weiner & Kukla, 1970). The items are:

I prefer (1) assignments that I might not be able to do or (2) assignments which I'm sure I can do.
I like a puzzle that (1) is hard to solve or (2) is easy to solve.
When I am doing an assignment that is easy for me, (1) I enjoy doing it or (2) I become bored doing it.
If I had to choose a work partner, I would prefer (1) the hardest worker or (2) the friendliest student.

While a Cronbach's alpha of .50 was computed for this scale, it is greater than the reliability coefficient for the complete CAS found in at least one other study (Solomon & Kendall, 1976). Weiner and Kukla have shown evidence that the CAS has some predictive validity for fifth and sixth grade students; scores on the CAS were moderately good at predicting locus of control.

Cooperative and Competitive Attitudes. Students' orientation toward cooperativeness and competitiveness in school settings was assessed using items from Form B of the Minnesota School Affect Assessment (MSAA) (Johnson, 1974). The Cooperation score was derived from responses to three items dealing with feelings of cooperation with other students in schoolwork. Students were asked to indicate, on a four-point scale ranging from *never* to *always*, whether:

I like to help other students learn.
I like to learn by working together with other students.
Other students like to help me learn.

Similarly, the Competition score was based on responses to three items concerning feelings of competition with other students in schoolwork:

I like to get better marks than other students do.
I like to do better work than my friends.
My friends want to do better work than me.

Although admittedly primitively short from a psychometric perspective, these small cooperativeness and competitiveness scales have been shown to have internal consistencies of alpha .72 and .82, respectively, and test-retest reliabilities of .87 and .92, respectively (Ahlgren & Johnson, 1979).

Arousal-Seeking Tendency. Students' characteristically preferred arousal level, a trait that may determine their individual approach-avoidance reaction to particular classroom settings, was assessed using a 10-item inventory derived from an adult scale developed by Mehrabian and Russell (1974). Students were asked to indicate, on a four-point scale ranging from *never* to *always*, the degree to which each statement described themselves. Examples of the items are:

I imagine leaving home, just to explore the world.
When I grow up, I would like a job that is exciting and risky.
I like new things to happen to me everyday.

An alpha coefficient of .65 was computed for this scale.

Locus of Control. The locus of control dimension, researched extensively with adult samples, appears to have significant implications for the study of children's behavior (Krovetz, 1977). This construct, which recognizes that the effect of reinforcement "depends on whether or not the person perceives a causal relationship between his own behavior and the reward" (Rotter, 1966, p. 1), is assessed in the present study using items from a scale constructed specifically for children by Nowicki and Strickland (1973). The Nowicki-Strickland Locus of Control scale consists of 40 yes-no items; a 15-item subset of their abbreviated scale for grades three to six was employed in the study. Exemplary items are:

Is one of the best ways to handle most problems not to think about them?
Is it nearly impossible to change your parents' minds about anything?
Are most kids just born good at sports?

For the 40-item scale, Nowicki and Strickland reported estimates of internal consistency via the split-half method, corrected by the Spearman-Brown formula, of .63 (for grades three, four, five) and .68 (for grades six, seven, eight); no coefficient for the abbreviated scale was provided, although they postulated that this version should be a reliable measure of locus of control for children in grades three to six. A Cronbach's alpha of .56 was calculated for the 15-item scale used in the present study.

Task Persistence. Performance on a cognitive exercise was used to assess student's persistence on a difficult task. A lack of persistence, symptomatic of a "giving up" syndrome (Seligman, 1975), is considered a direct manifestation of helplessness. This exercise, where students were given a puzzle to assemble, was similar to one employed by Cohen et al. (1981). Toward the end of the interview, students were given a moderately difficult puzzle and instructed that they had three minutes to solve it. Whether the puzzle was solved, how long the solution took, and whether the student "gave up" before the three minutes had elapsed were used as measures of task persistence.

Non-Target Student Interviews

A second questionnaire was employed to assess the socioecological characteristics of the various classroom settings. The non-target students participating in the study were administered these questionnaires in groups, as an interview, with each classroom represented by a group. Group size ranged from four to 12 students, with eight being the mean. As before, the interviews were conducted by trained personnel during recess or some other free period. Students were assured that the questionnaire was not a test and that their teacher would not see their responses. Each student was then given an answer sheet on which to record his or her reactions.

In the present study the psychosocial classroom environment was assessed by employing the Classroom Environment Scale (CES) developed by Trickett and Moos (1973) (Appendix B). Consisting of 90 true-false items, the CES is defined by three domains characterizing diverse psychosocial environments: relationship dimensions, which identify the nature and intensity of personal relationships within the environment; personal growth or goal orientation dimensions, which assess the basic directions along which personal development tends to occur; and system maintenance and change dimensions, which measure the extent to which the environment is orderly, clear in expectations, maintains control, and is responsive to change. For classroom environments, Trickett and Moos have identified nine dimensions. Table 1 lists these subscales and gives brief definitions of each.

Moos and Trickett (1974) reported the following internal consistencies for the CES subscales, calculated using Kuder-Richardson Formula 20 and average within-classroom variances for the items: involvement, .85; affiliation, .74; teacher support, .84; task orientation, .84; competition, .67; order and organization, .85; rule clarity, .74; teacher control, .86; and innovation, .80. Fisher and Fraser (1983) reported data that are consistent with these reliability coefficients; in addition, they demonstrated that each CES subscale differentiated significantly between classrooms.

Behavioral Observation

Ten observers, all female, completed an extensive training program prior to conducting observations in the field. The program began with a review of the purposes and theory involved in the study followed by an explanation of the observation categories and the rules for their use. The rationale behind each category in relation to the theory and to specific hypotheses was indicated. The trainees practiced using videotaped classroom sessions; this was particularly helpful in checking and discussing events that were coded differently by different observers. Additional practice sessions allowing the trainees to observe actual student behavior in a sixth grade classroom (not part of the study) were held later. Reliability tests were conducted periodically; observers were certified after an acceptable level of reliability was attained.

Table 1

Classroom Environment Scale: Description of Subscales

	RELATIONSHIP DIMENSIONS
Involvement	Extent to which students have attentive interest, participate in discussions, do additional work, and enjoy the class.
Affiliation	Extent to which students help each other, get to know each other easily, and enjoy working together.
Teacher Support	Extent to which the teacher helps, befriends, trusts, and is interested in students.
	PERSONAL GROWTH OR GOAL ORIENTATION DIMENSIONS
Task Orientation	Extent to which it is important to complete activities planned and to stay on the subject matter.
Competition	Extent to which students compete with each other for grades and recognition.
	SYSTEM MAINTENANCE AND CHANGE DIMENSIONS
Order and Organization	Emphasis on students behaving in an orderly, quiet, and polite manner, and on the overall organization of classroom activities.
Rule Clarity	Emphasis on clear rules, on students knowing the consequences for breaking rules, and on the teacher dealing consistently with students who break rules.
Teacher Control	Extent to which rules are enforced and rule infractions are punished.
Innovation	Extent to which the teacher plans new, unusual, and varying activities and techniques, and encourages students to contribute to classroom planning and to think creatively.

Adapted from Fisher & Fraser, 1983

To maintain consistency, observations of target students occurred during a reading activity. Observers stood or sat along the perimeter of the classroom and avoided interacting with students and teachers. The children had been told earlier by their teachers that college students interested in learning more about what happens in classrooms would be coming to observe them; the students seemed to adapt readily to this situation. Raters were instructed to wait about ten minutes before commencing the observation sequences so that students could adjust to their presence. Individual students were unaware of when they were actually being observed.

Observation intervals were 30 seconds in duration and consisted of the following: five seconds devoted to finding the individual target student; ten seconds of actual observation; and 15 seconds for recording the observed behaviors. Each behavior category that occurred within the ten-second period was recorded. Two raters were present in each class, observing simultaneously, and using individual, randomized checklists so that they cycled through the target students in a different order. Thus at any particular instance, two different students were being observed. Each student was observed for two consecutive 30-second intervals, and then the observer moved on to the next student. These procedures yielded up to 16 observation intervals per target student during the allotted time.

Each observer had a checklist (Appendix C) that included categories for discrete behavioral acts (e.g., physical contact) as well as for qualitative aspects of these acts (e.g., the appropriateness of the behavior). The former required yes-no judgments and the latter necessitated inferences from the observers. To maintain a relatively low inference level, specific criteria were developed for each qualitative judgment. Several of the categories used in the study were derived from a system developed by Whalen, et al. (1978). Of interest were behaviors that typically have been associated with academic and social success: classroom participation, task attention, and disruptive behaviors. In addition, behaviors were observed that may be indicative of adaptive responses to stressors in the classroom. Brief definitions of the observation categories are presented below:

Physical Contact/Personal Space Invasion. Scored whenever the student contacted another person with his or her body (especially hands and feet) or with an object. This type of behavior was expected to be absent in students under duress; maintenance of personal space is used in coping with a variety of stressors (cf. Evans, 1978). For example, responses to crowding caused by a surfeit of people may involve withdrawal and avoidance of social contacts (cf. Baum & Koman, 1976).

Teacher-Initiated Participation. Scored when the student responded to a substantive question or comment from the teacher.

Unsolicited Participation. Scored when the student participated in a class activity without a prompt from the teacher.

Social Interaction. Rated whenever the student was clearly trying to initiate interaction or make contact with another person, such as starting a conversation.

Vocalization. Scored when the student made a nonverbal noise with his or her mouth, such as humming or tongue clucking. Like the observation category for fidgeting behaviors (see below), vocalization was used as an index of general nervousness and restlessness. Whalen et al. (1978) have demonstrated that higher rates of vocalization and fidgeting are characteristic of children diagnosed as being hyperkinetic.

Qualitative characteristics of the above five categories were further rated on a three-point scale (positive, negative, and regular). Negative was scored if the observer judged that a typical other would find the behavior unpleasant, aversive, or intrusive. An occurrence was scored as positive if the observer judged that a typical other would find the contact pleasant and comfortable. Regular was scored in the absence of clear and compelling evidence of positive or negative qualities in the behavior exhibited.

Student Questions to Teacher. Questions were divided into two primary types. Content questions dealt with material that students could conceivably be tested on ("What is gravity?") whereas process questions were all other inquiries that were not content-oriented ("May I go to the restroom?").

Fidget/Movement. Scored whenever the student's hands, head, or feet were continuously in motion for more than three seconds. Also scored if the behavior involved tinkering or playing nervously with an object.

Translocation. Occurred when the student moved a minimum of two steps or three feet from one place to another.

Task Attention. On-task was coded when the student was completing class assignments or following the teacher's directions. If there was an assigned task that the student was not working on, off-task was coded.

Disruption. Disruption was rated whenever the student's behavior had observable consequences that interrupted other students' behavior.

Before completing an observation interval, the observer indicated which of five ongoing classroom situations were in effect during the interval: the teacher working with the entire class; the teacher working with a group of children, including the target student; the teacher working with a group of children, but not with the target student; the teacher working individually with the target student; or the teacher circulating through the class while the students work independently.

Teacher Questionnaire

Information about the specific ways each teacher approached elementary school education, their teaching objectives, and their overall teaching philosophy was obtained. In addition to student perceptions of the psychosocial climate of classroom settings, the present study was interested in identifying the influence teaching style may have on the various outcome measures, as well as its relationship to spatial characteristics of the classroom. It was also important to develop a distinction between open versus traditional *facilities* and open versus traditional *educational philosophies* since past research on so-called "open classrooms" has failed to make clear whether the investigators were measuring effects of building layout, of teacher-student relations, of both, or of something else (Horwitz, 1979).

A questionnaire was given to each teacher with a request that it be mailed back to the investigator within a few days; stamped, self-addressed envelopes were provided for their convenience. The questionnaire (Appendix D) contained approximately 60 forced-choice items covering a number of topics, including teaching methods, teaching aims, and educational philosophy. Questions about teaching methods pertained to determination of seating arrangements, rules in the classroom, organization of the curriculum, grading policies, and disciplinary measures used. Teachers were also asked to rate the importance in their class of a variety of teaching objectives, such as:

Preparation for academic work in secondary school.
The encouragement of self-expression.
The acceptance of normal standards of behavior.

The degree to which teachers subscribed to an open versus a traditional teaching philosophy was measured with a nine-item inventory. Teachers were asked to indicate, on a five-point scale ranging from *strongly disagree* to *strongly agree*, their level of agreement with various statements that commonly have been used to characterize open and traditional approaches to education (cf. Barth, 1972; Rathbone, 1971). Example items are:

Most pupils in upper elementary school have sufficient maturity to choose a topic to study and carry it through.
Children working in groups waste a lot of time arguing and "messing about."

A Cronbach's alpha of .70 was calculated for the educational philosophy scale.

Finally, teachers were given descriptions of a number of behaviors and were asked to rate target students in their class in terms of these behaviors. Seventeen of the items, comprising the Matthews Youth Test for Health (MYTH-Form O)

(Matthews & Angulo, 1980), were employed to assess the presence of a coronary-prone behavior pattern. Teachers were asked to indicate, on a five-point scale ranging from *extremely uncharacteristic* to *extremely characteristic*, whether the particular items described the child in question. For example:

> Works quickly and energetically rather than slowly and deliberately.
> Seems to perform better than usual when competing against others.
> It is important to this child to win, rather than to have fun in games or schoolwork.

The MYTH also yields two orthogonal factors: competitiveness and impatience-aggression. Matthew and Angulo reported alpha coefficients of .90, .89, and .88 for the Type A scale and the two subscales, respectively, indicating that the MYTH is an internally consistent instrument.

In addition to rating individual target students in terms of pattern A characteristics, teachers were asked if those students were often absent from school.[10]

Classroom Design Characteristics

Systematic observation of physical traces can reveal much about an environment and the people who use it (Zeisel, 1981). In this study, identifying differences between classroom settings was as important as recognizing individual differences among students. The physical properties of the various classrooms were inventoried, usually at the end of the school day, after the occupants of the classrooms had left. Floor plans were drawn of each classroom; the diagrams contained assorted measurements, notes of where objects were located, and annotations of other observed features. As summarized in Table 2, three categories of information were collected: spatial characteristics, perimeter structures, and classroom amenities.

Spatial characteristics included measurements of the available floor area, the average ceiling height, the square footage and cubic footage per student, the

Table 2

Classroom Design Characteristics

CLASSROOM SPATIAL CHARACTERISTICS

Assignable Square Feet
Average Ceiling Height
Average Number of Workstations per Cluster
Cubic Footage per Student
Square Footage per Student
Arrangement of Workstations
Furniture as Percentage of Floor Space
Volume of Classroom

CLASSROOM PERIMETER STRUCTURES

Open Perimeter Space as Percentage of Perimeter
Non-Permanent Walls as Percentage of Perimeter
Permanent Walls as Percentage of Perimeter
Variable Height Walls as Percentage of Perimeter
Erected Barriers as Percentage of Open Perimeter Space

CLASSROOM AMENITIES

Square Feet of Blackboard Area
Carpeting
Type of Workstations
Percentage of Student Displays on Walls
Percentage of Teacher Displays on Walls
Number of Living Things in Classroom
Secluded Study Space Within Classroom
Secluded Study Space Outside Classroom
Soft Furnishings
Square Feet of Window Area

amount of floor area occupied by furniture, whether student workstations were arranged in rows or clusters, and the number of workstations in each cluster.

The manner in which the boundaries of the classrooms were expressed was recorded. Perimeter structures of interest included full height permanent walls, full height nonpermanent walls, variable height walls, and open perimeter space. By calculating the percentage of the total perimeter occupied by each of these structures, a more objective measure of a classroom's containment or openness can be computed (Ahrentzen, 1980). Also measured was the percentage of open perimeter space occupied by furniture.

Classroom amenities were other features that contributed to the "quality" of the classroom. Noted were the presence (or absence) of carpeting, living objects such as plants or small animals, soft furniture, and secluded study space. Secluded study space was either contained in the classroom or was adjacent to the classroom and shared with several other classes. The amount of blackboard and window area present in the classroom was also recorded, as was the proportion of student-produced exhibits tacked on the walls (in contrast to displays made commercially or by the teacher). Finally, we noted whether students sat at individual desks or at tables shared by two or more students.

Notes

1. Fourth, fifth, and sixth grade classes were recruited exclusively in order to minimize potential differences due to age as well as to improve the reliability of information obtained from student interviews.

2. A discussion of the major advantages of nonprobability sampling, together with the implications of using nonprobability methods, may be found in Selltiz et al. (1959).

3. Actual enrollment figures were unavailable for five of the classes. Estimates were obtained by counting the number of primary work stations contained in each of the respective classrooms.

4. Although 278 consent forms were returned, absentees reduced the subject pool to 255 students.

5. The problems with using subjective, self-report measures for both independent and dependent variables have been discussed at length by several investigators in the stress and health field (cf. Evans & Cohen, 1987; Kasl, Will, White, & Marcuse, 1982).

6. Prompted by concerns about external validity, measures took place in April and May because it was believed that students would have had sufficient time to acclimate to their classrooms by the fourth quarter of the school year. At the same time, however, it was imperative that data be collected before the last month of the school year (June) due to possible behavior fluctuations brought about by students' anticipation of summer recess.

7. The principal comment received from both teachers and students during the pretesting of this questionnaire was that it contained far too many items;

interviews averaged in excess of 30 minutes. Given the fact that one of the major concerns for school administrators was the amount of time they would have to invest in the study, the questionnaire was shortened so that the interviews could be completed in 15 to 20 minutes.

8. The questionnaire was administered to students in the form of an interview in order to negate any differences due to reading ability. An interview format also allowed interviewers to assess respondent comprehension of the questions.

9. A global measure of classroom satisfaction was developed after factor analysis of the items failed to reveal any discernable subscales. Cronbach's alpha, like other measures to determine the internal consistency of tests, takes into consideration the variation of student responses to all test items. The reliability coefficient obtained provides an estimate of test consistency at a specific time. Encompassing both the Spearman-Brown and the Kuder-Richardson 20 formulae, coefficient alpha can be considered an estimate of the expected correlation between an actual test and a hypothetical alternative form of the same length (Nunnally, 1978).

10. It was originally intended to secure access to school records for additional information on target students (e.g., achievement scores, absenteeism, trips to the school nurse, and other possible indicators of student well-being). Privacy concerns on the part of school administrators, however, precluded the availability of these records.

RESULTS

Comments on Research Strategy and Implications for the Interpretation of Results

The present study attempts to evaluate interaction effects in natural settings, without the advantage of deliberate manipulation and controls, and is primarily exploratory in nature. The principal purpose is to sift out a set of propositions about the relations between children and their classroom environments that might indicate further promising areas of inquiry. In contrast, a more conventional objective, in which conclusions about relations are drawn based upon tests of statistical significance, would be over-ambitious in this case. This is true because a number of methodological shortcomings associated with the nonequivalent control group design can seriously compromise the validity of any statistical inferences (see e.g., Campbell & Stanley, 1963; Cook & Campbell, 1979). For example, field research, and in particular educational research, is most often characterized by the inability of the investigator to establish sampling equivalence between control and treatment groups because the groups are naturally assembled collectives, such as classrooms. Yet, even with these limitations, the disciplined use of inferential methods can help to sort shadow from substance and may suggest avenues for further study. If causal assertions are going to be made, then consideration of potential threats to the validity of the inferences is most critical.

In the present study, interaction predictions were made for intact groups and depended on observations of concomitancies as they occurred in the classroom environment. Manipulations of environmental factors (i.e., the predicted causal variables) were not possible. Furthermore, pretest information was unavailable for the target students. In most quasi-experimental situations, the absence of pretest information invalidates the testing of causal relationships. Nonetheless, relatively strong inferences about cause may be derived from the posttest-only, passive-observational research design since interaction predictions are made (Cook & Campbell, 1979). There remains, however, several inherent difficulties with this design. The major threat is selection, where an observed effect may be due instead to unaccounted-for differences between groups. Because causal interpretation tends to be facilitated as the predicted interaction between nonequivalent groups grows more complex, the plausibility of selection may be reduced by hypothesizing a second- or third-order interaction. The problem with this approach, however, is that the probability of obtaining specific and expected data outcomes decreases with the very specificity of the predictions.[1] Another potential problem with this design involves construct validity and confounding, where a relationship presumed to be caused by a particular theoretical construct may also be construed in terms of other constructs. Despite these complications, an interaction prediction design can be useful if carefully interpreted. The interpretability of the design depends in large measure on how well these threats can be explicitly ruled out or rendered less plausible.

In the following sections, consideration is given to several methodological issues relevant to the present study of interactions between students and their educational environment: testing hypotheses about interactions, using product terms in multiple regression analysis, and determining an appropriate significance level.

Testing Hypotheses About Interactions

Significance testing, or the process of comparing hypotheses in the light of sample evidence, enables us to "analyze some of the causal factors out of complex and otherwise bewildering events" (Guilford, 1942, p. 4). Tests of significance, then, are used mainly for deriving general explanations about phenomena from sample observations rather than for describing unique situations. In order to justify the making of such conclusions, however, a number of assumptions must be met. In some circumstances, violation of these assumptions may have very serious consequences on the conclusions reached; in others, the effects may be only minor. Foremost among the assumptions in hypothesis testing is that the sample is random; without randomization, threats to internal validity cannot be controlled and there is little confidence for rejecting rival hypotheses. Also, it frequently is assumed that random variables are mutually exclusive and independent, that the occurrence of one event in no way affects the probability of the other event. In the present study, however, randomization was out of the question since students could not be assigned by the investigator to particular classroom environments.[2] Furthermore, in nonexperimental research, variables are almost always correlated with each other (in addition to the likely possibility of being correlated with variables not considered in the design).

Because of the these problems, the results reported in this paper must be interpreted with caution for it is unlikely that competing explanations can be dismissed confidently, nor can observed effects be generalized definitively. Yet, though these conditions may be serious enough to weaken any statement about the cause of observed differences, tests of significance can still provide "a relevant and useful way of assessing the relative likelihood that a real difference exists and is worthy of interpretive attention" (Winch & Campbell, 1969, p. 140). Indeed, most social science researchers are reconciled to the fact that causal explanations will continue to be molar and contingently causal; since it is difficult to conceptualize and test all of the relevant contingent conditions under which the cause will lead to the effect, many genuine effects will appear to occur sporadically (Cook & Campbell, 1979). The primary intent of using significance tests in this study is to answer questions about whether interaction effects in classrooms can be demonstrated at all in a quasi-experiment, and to provide some direction for subsequent research in this area.

The most common statistical test for the presence of interactions takes one of two forms: an analysis of variance with aptitude (e.g., arousal-seeking tendency) and treatment (e.g., square footage per student) blocked and entered as factors, or a test on the hypothesis of uniform aptitude-treatment regression slopes (cf. Cohen & Edwards, 1989; Cronbach & Snow, 1977). One disadvantage of using an analysis of variance is that continuous predictor variables must be partitioned and treated in the analysis as categorical variables. This practice is particularly problematic in nonexperimental research because it casts the design in what appears to be a factorial analysis of variance, giving the illusion that the investigator has experimental control over the independent variables. In addition, categorization of continuous variables leads to a loss of information about differences between subjects, and consequently leads to a less sensitive analysis under most circumstances (Cohen, 1968). Finally, as discussed in an earlier section of this paper, the practice of partitioning continuous variables may be partly to blame for the conflicting evidence found in the research literature on classroom environments.[3]

Multiple regression, in which coronary-prone behavior pattern, arousal-seeking tendency, and various classroom factors were treated as independent variables in separate regression analyses, was the statistical technique used herein in order to exploit the continuous nature of many of the predictor variables employed in the present study. Following the customary procedure for testing the significance of interaction effects in regression analyses, product terms representing the interactions were entered hierarchically after both the variables forming the product had been entered as main factors (see e.g., Cohen, 1978). The purpose was to test whether the interaction term incremented significantly the proportion of variance in the dependent variable accounted for by the independent variables alone.[4] If so, then the factors are said to have interacted with each other.

Product Terms and Interactions

While the mechanics of testing for an interaction in multiple regression analysis are generally accepted - with the vector representing the interaction entered after the vectors representing the main effects, thereby partialing the latter out of the former - there appears to be widespread disagreement over the interpretation of the results. Pedhazur (1982) argued that the term "interaction" should be reserved for factorial designs in experimental research, and that for nonexperimental settings the proportion of variance accounted for by product vectors should be interpreted as indicating "multiplicative," or "joint," relations. References to interactions may be misleading, according to this point of view, because certain aspects of nonexperimental research (e.g., a high probability of specification errors due to the inability to randomly assign subjects to treatments) increase the risk that variables being studied are correlated with variables that are not included in the design. On the other hand, some authors are emphatic in their insistence that product terms *are* interactions (see e.g., Allison, 1977; Cohen, 1978). For example, Cohen stated that "the methodological clock would be turned back at least a decade" (p. 858) if critics of product vectors were to be taken seriously. For the present purpose, it is sufficient to recognize the fact that there are divergent opinions regarding the distinction between interactions and multiplicative relations. Regardless, the term "interaction" continues to be employed here in order to maintain consistency with the person-environment interaction model presented earlier in this paper.

In the present analysis, the finding of a significant product term was followed by an examination of the pattern of the interaction effect. To do this, regression coefficients were calculated from the final regression equation in which all terms were corrected for all others. This type of simultaneous, product-term regression analysis, however, may be problematic for the interpretation of main effects since the magnitude and significance of the effect of a given factor depends upon the values of the other factors with which it is combined (Cleary & Kessler, 1982; Finney, Mitchell, Cronkite, & Moos, 1984). While several methods for estimating main effects in the presence of a significant interaction have been proposed (see e.g., Cramer & Appelbaum, 1980; Marsden, 1981; Overall, Lee, & Hornick, 1981), Finney et al. recommended the "average-effect" approach in which the main effect is interpreted as the effect of a variable at the average observed score on the moderator variable. This method was used in the present analysis: raw scores on the independent variables were transformed by subtracting their respective means prior to the regression analysis. As a result, the estimated main effect is still that at the zero point of the moderator variable, but now the zero point is the mean of the moderator variable.[5]

The deviation-score transformation has no effect on the magnitude and significance of the interaction terms; it does, however, influence the magnitude of the main effects for the constituent variables. Furthermore, this transformation changes the standardized regression coefficients for both the constituent variables and the interaction terms. For this reason, standardized coefficients do not reflect the relative importance of variables included in a multiplicative regression analysis, and the use of unstandardized coefficients is preferable.[6]

Levels of Significance

In significance testing, we are always confronted with the risk of making one of two types of error: we can incorrectly reject a true null hypothesis (Type I, or alpha, error), or we can accept the null hypothesis when, in fact, it is false (Type II, or beta, error). The two types of errors are inversely related; that is, minimizing the probability of a Type I error increases the probability of making a Type II error. Determining an acceptable probability of Type I error, or significance level, of a test is done arbitrarily, though in theory it is based on a judgment about which kind of error is more important and is to be avoided. Within the behavioral sciences, the conventional view is that Type I errors are more serious than Type II errors, meaning that "the failure to find is less serious than finding something that is not there" (Cohen, 1969, p. 54); thus, it is common to adopt levels of significance of either .05 or .01.

The exploratory stance towards the data taken in the present study, and referred to earlier, supports a less conservative setting of significance levels. The investigator's interest lies much more in moving scientific study ahead by developing and refining hypotheses about the interaction between students and their environment than in reaching "conclusions" per se. In the absence of strong reasons to the contrary, the probability of making a Type I error is not *necessarily* more serious than failing to recognize a true effect. In order to strike a reasonable balance between the two types of error, given the aims of this study, we report as significant relations with alpha set at .10 rather than the more conventional .05. The acceptability of a .10 significance level in two-tailed tests has been supported for interaction studies which examine stress-buffering effects (Cohen & Edwards, 1989).

Analyses to Investigate the Interaction Between Individual Differences and Classroom Physical Design Factors

It was hypothesized earlier that coronary-prone behavior pattern and arousal-seeking tendency interact with classroom design factors (density, openness of perimeter, amount of window area, type of desk arrangement, and the presence or absence of secluded study space) to moderate relations between stressful events and behaviors symptomatic of dysfunctional coping. Preliminary descriptive analyses were performed on the various outcome measures outlined in the Methods section, revealing four that contained sufficient variance, were void of major psychometric weaknesses (e.g., low internal consistency), and that represented a range of response types collected via a variety of methodologies: absenteeism (an indicator of well-being, compiled through teacher ratings), task inattention and fidgeting (both behavioral outcomes, measured using observational techniques), and cooperativeness (an attitudinal preference, collected by way of interviews with target students). Scores on these measures were treated as dependent variables in separate regression analyses.

To control for possible variance in the outcome measures due to differences in the psychosocial qualities of the classrooms under study, covariates were identified for inclusion in the regression analyses. Intercorrelations of the outcome measures with scores on the Classroom Environment Scale are shown in Table 3.[7] For absenteeism, coefficients of .19 or above were found for the involvement, affiliation, order and organization, and rule clarity subscales; with the exception of the correlation between affiliation and rule clarity, $r(110) = .15$, *ns*, these subscales were highly intercorrelated. Scores for innovation were significantly correlated with task inattention, $r(110) = -.33$, $p < .001$. Fidgeting was correlated with both teacher support and rule clarity, although the relation was stronger with rule clarity, $r(110) = .26$, $p < .01$; these two subscales were moderately correlated. There were no significant zero-order correlations between cooperativeness and the CES subscales. In summary, the following covariates, listed with their respective dependent variables, were included in the regression analyses: for absenteeism, affiliation and rule clarity; for task inattention, innovation; and for fidgeting, rule clarity.

All of the following analyses relate to the group of 110 target students, representing 14 classrooms, for whom complete data were available.[8]

Means, Standard Deviations, and Intercorrelations of Measures

The means, standard deviations, and intercorrelations of the individual difference scores, classroom design variables, and the outcome measures are shown in Table 4. Arousal-seeking tendency and coronary-prone behavior pattern were

Table 3

Pearson Intercorrelations of Outcome Measures and Classroom Environment Subscales

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Absenteeism	–												
2. Task Inattention	.07	–											
3. Fidgeting	-.03	.32***	–										
4. Cooperativeness	-.02	-.12	.16	–									
5. Involvement	-.29**	-.17	.06	-.01	–								
6. Affiliation	-.19*	-.16	-.11	-.03	.71***	–							
7. Teacher Support	-.18	-.07	.19*	-.01	.70***	.51***	–						
8. Task Orientation	-.14	-.02	.04	.09	.23*	.14	-.05	–					
9. Competition	.11	.16	.09	.06	-.72***	-.66***	-.47***	.13	–				
10. Order and Organization	-.22*	-.14	.14	.11	.74***	.66***	.42***	.45***	-.47***	–			
11. Rule Clarity	-.22*	-.11	.26**	.05	.38***	.15	.22*	.29**	.14	.50***	–		
12. Teacher Control	-.01	.10	.18	.09	-.17	-.44***	-.22*	.01	.44***	-.10	.42***	–	
13. Innovation	-.07	-.33***	.10	.16	.42***	.54***	.30***	.32***	-.40***	.53***	.09	-.49***	–

Note. $N = 110$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4

Means, Standard Deviations, and Pearson Intercorrelations of
Individual Differences, Classroom Design Factors, and Outcome Variables

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Arousal-Seeking Tendency	29.70	4.32	–										
2. Coronary-Prone Pattern	49.34	12.18	.06	–									
3. Density	34.94	8.58	.04	.00	–								
4. Openness of Perimeter	16.20	21.14	.10	-.06	.38***	–							
5. Window Area	88.36	97.77	-.01	.08	.23*	-.23*	–						
6. Desk Arrangement[a]	.44	.50	.09	-.06	-.27**	.57***	-.60***	–					
7. Secluded Study Space[a]	.38	.49	-.11	-.05	.42***	-.29**	.05	-.35***	–				
8. Absenteeism	1.38	.86	.02	-.20*	-.04	.11	.01	.01	-.18	–			
9. Task Inattention	.12	.13	-.18	.25**	.14	.07	.09	-.22*	.12	.07	–		
10. Fidgeting	.24	.17	.11	.05	.25**	.27**	-.17	.13	.00	-.03	.32***	–	
11. Cooperativeness	9.30	1.55	.20*	-.11	.00	.04	-.03	.10	.05	-.02	-.12	.16	–

Note. $N = 110$.

[a] These variables were coded 0 and 1.

* $p<.05$. ** $p<.01$. *** $p<.001$.

not significantly correlated with density, openness of perimeter, window area, desk arrangement, and secluded study space (the other independent variables in the regression analyses). Among themselves, however, the classroom factors were moderately intercorrelated, all coefficients ranging between .23 and .60 with the exception of the correlation between window area and secluded study space, $r(110)=.05$, *ns*. The four outcome measures, the dependent variables in the regression analyses, were not highly intercorrelated, although the correlation between fidgeting and task inattention was found to be significant, $r(110)=.32$, $p<.001$. There were also significant zero-order correlations between these measures and the independent variables. Absenteeism was negatively related to coronary-prone behavior pattern; task inattention was positively related to coronary-prone behavior pattern and negatively related to type of desk arrangement; fidgeting was positively related to density and openness of perimeter; and cooperativeness was positively related to arousal-seeking tendency.

There were no significant differences between target students in the 14 classrooms in mean levels of coronary-prone behavior pattern, $F(13, 96)=1.36$, *ns*, or arousal-seeking tendency, $F(13, 96)=1.08$, *ns*.

Coronary-Prone Behavior Pattern

The following discussion relates to analyses involving the first of two individual difference measures, coronary-prone behavior pattern. As described earlier in this chapter, absenteeism, task inattention, fidgeting, and cooperativeness were treated as dependent variables in separate hierarchical regression analyses, the predicted interaction models being tested by including the appropriate product terms in the analyses. For each analysis, the covariates (if any), the measure of coronary-prone behavior pattern, and one of the five classroom factors were entered hierarchically, in that order, followed by the product term representing the interaction. Only predicted interactions were included in the regression analyses.

In addition, regression coefficients were derived from the final regression equations (in which each term was corrected for all other terms) in order to examine the nature of significant interaction effects for the outcome measures. As recommended by Finney et al. (1984), the regression coefficients were calculated from the a priori multiplicative models rather than from reduced models (in which nonsignificant interaction terms are dropped from the analyses).

Classroom Density

Regression analyses involving coronary-prone behavior pattern and classroom density are shown in Tables 5, 6, 7, and 8. The multiplicative model explained a significant proportion of the variance in absenteeism, task inattention, and fidgeting, but failed to do so for cooperativeness. The analyses confirmed that coronary-prone behavior pattern, after adjusting for relevant psychosocial characteristics of the classrooms, was a significant overall predictor of absenteeism and task inattention. Density (quadratic term) was also a significant predictor of task inattention. Furthermore, the predicted interaction between coronary-prone behavior pattern and the quadratic component of density was significant for task inattention, $F(1, 103)=3.60$, $p<.06$, and fidgeting, $F(1, 103)=3.17$, $p<.08$, when entered hierarchically after the main factors; for task inattention, the linear interaction was highly significant as well, $F(1, 104)=13.16$, $p<.001$. In analyses of task inattention and fidgeting scores, the interactions across levels accounted for 37.2 percent and 32.2 percent of the total explained variance, respectively.

Figure 4 shows the curvilinear relations between classroom density and task inattention for Type A (1 *SD* above the mean) and Type B (1 *SD* below the mean) levels of coronary-prone behavior pattern. (The regression coefficients shown in Table 6 were used to determine the regression equation.) It can be seen that marked differences in the frequency of off-task behavior between Type A and Type B students occurred only at lower levels of classroom density, Type A students

Table 5

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Classroom Density in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Rule Clarity Affiliation	.073	.073	4.44 2.76	1, 107 1, 107	<.04 <.10	57.9	-0.17432* -0.15095*
+ Coronary-Prone Behavior Pattern	.122	.049	5.91	1, 106	<.02	38.9	-0.01480*
+ Density (linear)	.124	.002	0.30	1, 105	*ns*	1.6	0.00450
+ Density (quadratic)	.124	.000	0.00	1, 104	*ns*	0.0	0.00006
+ Coronary-Prone Behavior Pattern x Density (linear)	.126	.002	0.21	1, 103	*ns*	1.6	-0.00002
+ Coronary-Prone Behavior Pattern x Density (quadratic)	.126	.000	0.01	1, 102	*ns*	0.0	-0.00001

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(7, 102) = 2.11$, $p < .05$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .10$.

Table 6

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Classroom Density in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	35.9	-0.04186***
+ Coronary-Prone Behavior Pattern	.145	.034	4.24	1, 107	<.05	11.0	0.00038
+ Density (linear)	.163	.018	2.34	1, 106	*ns*	5.8	-0.00270
+ Density (quadratic)	.194	.031	4.03	1, 105	<.05	10.0	0.00022*
+ Coronary-Prone Behavior Pattern x Density (linear)	.285	.091	13.16	1, 104	<.0004	29.4	-0.00005
+ Coronary-Prone Behavior Pattern x Density (quadratic)	.309	.024	3.60	1, 103	<.06	7.8	0.00002*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(6, 103) = 7.67$, $p < .001$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .10$. ** $p < .01$.

Table 7

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Classroom Density in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	< .006	48.3	0.02344
+ Coronary-Prone Behavior Pattern	.072	.003	0.35	1, 107	*ns*	2.1	-0.00094
+ Density (linear)	.094	.022	2.65	1, 106	*ns*	15.4	0.00602
+ Density (quadratic)	.097	.003	0.30	1, 105	*ns*	2.1	-0.00012
+ Coronary-Prone Behavior Pattern x Density (linear)	.117	.020	2.31	1, 104	*ns*	14.0	-0.00032
+ Coronary-Prone Behavior Pattern x Density (quadratic)	.143	.026	3.17	1, 103	< .08	18.2	0.00002*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(6, 103) = 2.86, p < .025$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .10$.

Table 8

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Classroom Density in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Coronary-Prone Behavior Pattern	.011	.011	1.23	1, 108	*ns*	39.3	-0.00743
+ Density (linear)	.011	.000	0.00	1, 107	*ns*	0.0	0.01878
+ Density (quadratic)	.015	.004	0.41	1, 106	*ns*	14.3	-0.00089
+ Coronary-Prone Behavior Pattern x Density (linear)	.026	.011	1.14	1, 105	*ns*	39.3	-0.00005
+ Coronary-Prone Behavior Pattern x Density (quadratic)	.028	.002	0.22	1, 104	ns	7.1	-0.00006

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = .59$, *ns*.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

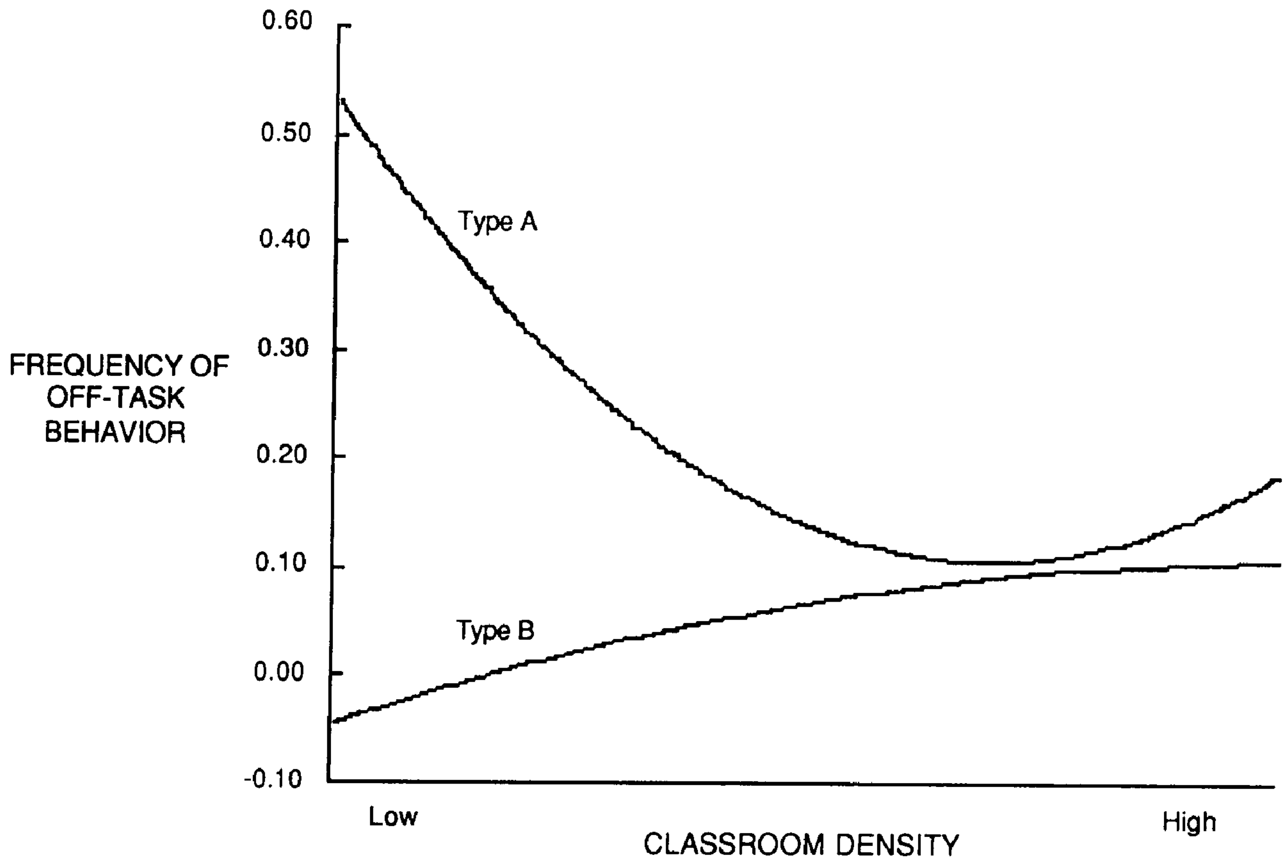

Figure 4. The relation between classroom density and task inattention for Type A (1 *SD*) and Type B (-1 *SD*) levels of coronary-prone behavior pattern. (The Frequency of Off-Task Behavior scale shows adjusted scores derived from the regression coefficients in Table 6.)

showing high inattentiveness and Type B students showing low inattentiveness. For Type As, the curve was of the predicted form: a U-shape with the lowest levels of off-task behavior occurring at moderate levels of density. The effect of density was much less marked for Type Bs.

The curvilinear interaction between coronary-prone behavior pattern and density for fidgeting is shown in Figure 5. As with task inattention, Type A students and Type B students differed most conspicuously in their observed frequency of fidgeting behavior at lower levels of classroom density, Type As showing more restlessness than Type Bs. The more marked feature of the data, however, was the inverted U-shaped curve for Type B children with the highest levels of fidgeting occurring when the average square footage per student was centered within the density range of the sample.

Openness of Classroom Perimeter

As shown in Tables 9, 10, 11, and 12, the predictive interaction model involving coronary-prone behavior pattern and openness of classroom perimeter explained a significant proportion of the variance in absenteeism, task inattention, and fidgeting, but not in cooperativeness. Openness was highly significant as a predictor of fidgeting only. In addition, the predicted Coronary-Prone Behavior Pattern x Openness of Perimeter interaction, entered after the component terms in the regression analyses, was significant for absenteeism, $F(1, 104) = 3.20, p < .08$, and fidgeting, $F(1, 105) = 2.94, p < .09$; the predicted interaction for task inattention was not significant. Although significant, the interactions for absenteeism and fidgeting accounted for rather small proportions of the total explained variance (16.6 percent and 12.4 percent, respectively).

Figure 6 shows the interaction between coronary-prone behavior pattern and openness of classroom perimeter for absenteeism, determined from the regression coefficients in Table 9. For Type A students, absenteeism decreased as the amount

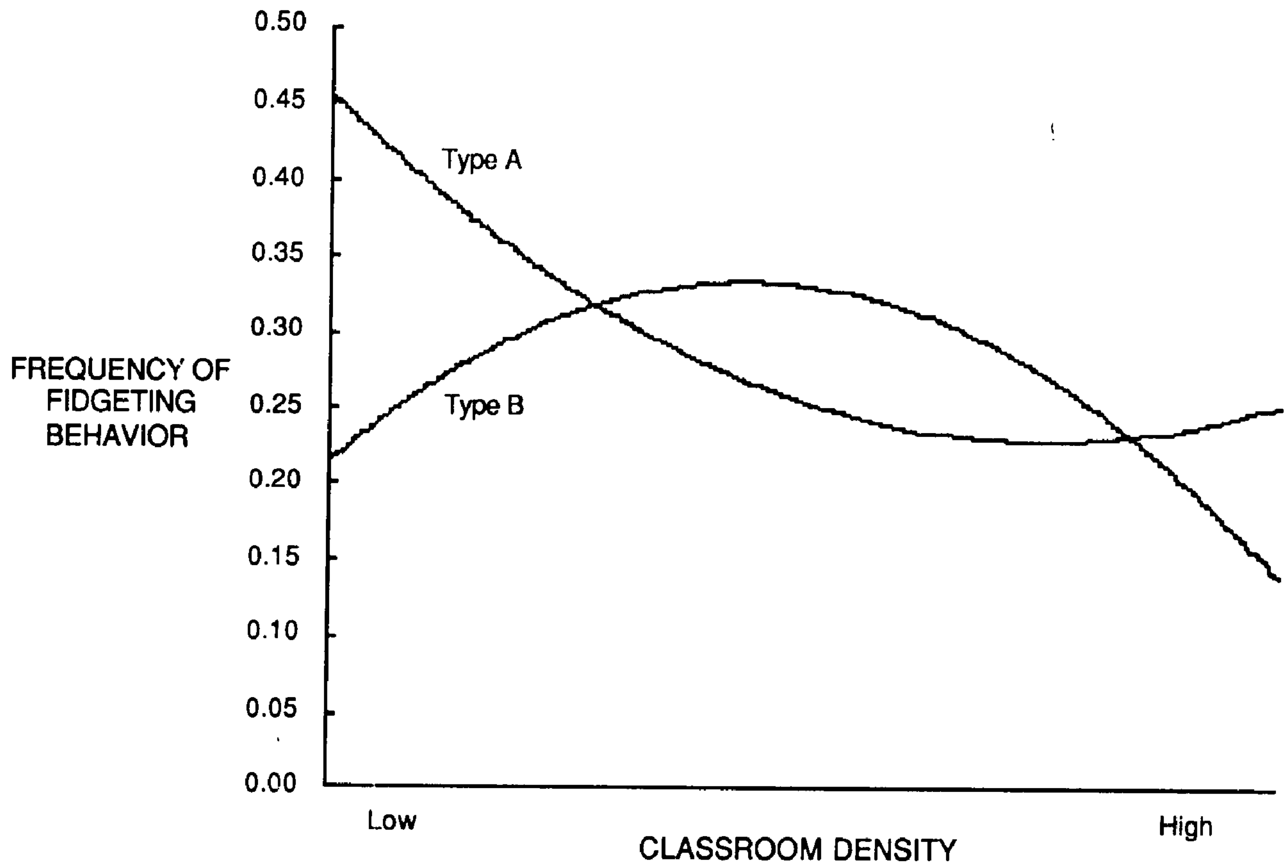

Figure 5. The relation between classroom density and fidgeting for Type A (1 *SD*) and Type B (-1 *SD*) levels of coronary-prone behavior pattern. (The Frequency of Fidgeting Behavior scale shows adjusted scores derived from the regression coefficients in Table 7.)

Table 9

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Openness of Classroom Perimeter in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	$<.04$	46.5	-0.14380**
Affiliation			2.76	1, 107	$<.10$		-0.13446*
+ Coronary-Prone Behavior Pattern	.122	.049	5.91	1, 106	$<.02$	31.2	-0.01402**
+ Openness of Perimeter	.131	.009	1.09	1, 105	*ns*	5.7	0.00302
+ Coronary-Prone Behavior Pattern x Openness of Perimeter	.157	.026	3.20	1, 104	$<.08$	16.6	-0.00054*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 3.87, p < .01$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .10$. ** $p < .05$.

Table 10

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Openness of Classroom Perimeter in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	69.8	-0.04520**
+ Coronary-Prone Behavior Pattern	.145	.034	4.24	1, 107	<.05	21.4	0.00213*
+ Openness of Perimeter	.159	.014	1.83	1, 106	*ns*	8.8	0.00078
+ Coronary-Prone Behavior Pattern x Openness of Perimeter	.159	.000	0.00	1, 105	*ns*	0.0	0.00000

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 4.98$, $p < .001$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .05$. ** $p < .01$.

Table 11

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Openness of Classroom Perimeter in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	37.1	0.04786***
+ Coronary-Prone Behavior Pattern	.072	.003	0.35	1, 107	*ns*	1.6	0.00124
+ Openness of Perimeter	.163	.091	11.60	1, 106	<.0009	48.9	0.00235**
+ Coronary-Prone Behavior Pattern x Openness of Perimeter	.186	.023	2.94	1, 105	<.09	12.4	-0.00010*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 6.00$, $p < .001$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .10$. ** $p < .01$. *** $p < .001$.

Table 12

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Openness of Classroom Perimeter in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Coronary-Prone Behavior Pattern	.011	.011	1.23	1, 108	*ns*	68.8	-0.01261
+ Openness of Perimeter	.013	.002	0.15	1, 107	*ns*	12.5	0.00221
+ Coronary-Prone Behavior Pattern x Openness of Perimeter	.016	.003	0.36	1, 106	*ns*	18.7	-0.00035

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(3, 106) = .58$, *ns*.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

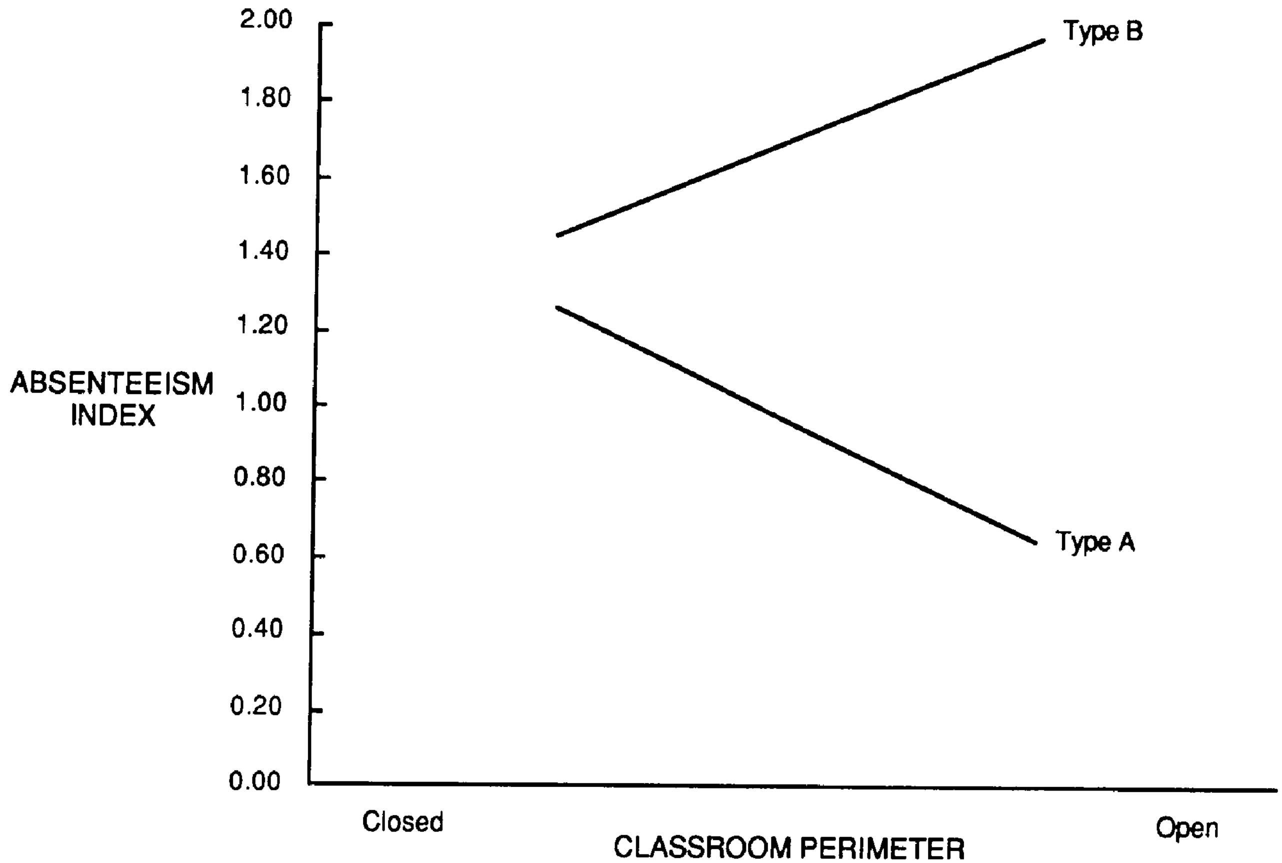

Figure 6. The relation between openness of classroom perimeter and absenteeism for Type A (1 *SD*) and Type B (-1 *SD*) levels of coronary-prone behavior pattern. (The Absenteeism scale shows adjusted scores derived from the regression coefficients in Table 9.)

of wall space defining the classroom decreased, whereas for Type B students, the tendency was for absenteeism to increase with increases in openness. Differences between Type As and Types Bs were most evident at higher levels of openness, and the overall level of absenteeism was lower for Type As.

As shown in Figure 7, a disordinal interaction between coronary-prone behavior pattern and openness of perimeter was found for fidgeting, the crossover point of the regression lines occurring at a moderate level of openness. For Type B students, openness had a marked effect on restlessness, fidgeting increasing as the percentage of the classroom perimeter characterized by open space increased. In contrast, for Type A students, the effect of openness on fidgeting was negligible.

Amount of Window Area

Analyses of the outcome measures, shown in Tables 13, 14, 15, and 16, confirmed that the multiplicative model involving coronary-prone behavior pattern and classroom window area explained a significant proportion of the variance for absenteeism, task inattention, and fidgeting; the interaction model, however, again failed to reach significance for cooperativeness. As a main factor, amount of window area was not a significant predictor of any of the outcome measures, but the predicted interaction between this variable and coronary-prone behavior pattern (entered hierarchically after the constituent terms) was significant for both task inattention, $F(1, 105)=3.65$, $p<.06$, and fidgeting, $F(1, 105)=5.86$, $p<.02$. The interaction across levels accounted for 16.6 percent of the explained variance in task inattention and 38.6 percent in fidgeting.

The interaction between coronary-prone behavior pattern and window area for task inattention is shown in Figure 8. (The regression equation was determined from the regression coefficients in Table 14.) Distinct differences in the frequency of off-task behavior between Type A and Type B students occurred only at higher levels of fenestration, Type A students showing high inattentiveness and Type B

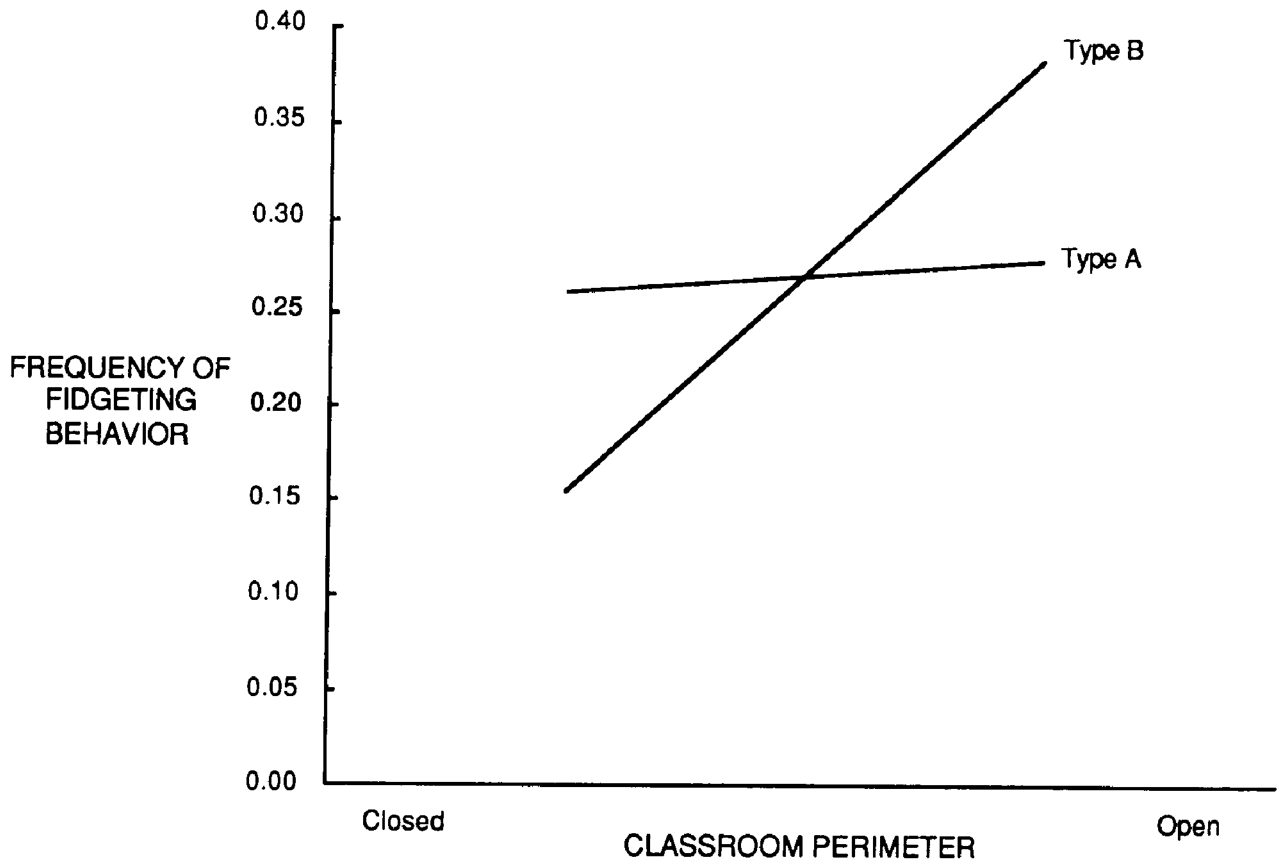

Figure 7. The relation between openness of classroom perimeter and fidgeting for Type A (1 *SD*) and Type B (-1 *SD*) levels of coronary-prone behavior pattern. (The Frequency of Fidgeting Behavior scale shows adjusted scores derived from the regression coefficients in Table 11.)

Table 13

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Amount of Window Area in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	<.04	54.1	-0.18917*
Affiliation			2.76	1, 107	<.10		-0.16800*
+ Coronary-Prone Behavior Pattern	.122	.049	5.91	1, 106	<.02	36.3	-0.01536*
+ Window Area	.131	.009	1.14	1, 105	*ns*	6.7	-0.00092
+ Coronary-Prone Behavior Pattern x Window Area	.135	.004	0.43	1, 104	*ns*	3.0	0.00004

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 3.24, p < .01$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .05$.

Table 14

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Amount of Window Area in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	63.4	-0.04349**
+ Coronary-Prone Behavior Pattern	.145	.034	4.24	1, 107	<.05	19.4	0.00198*
+ Window Area	.146	.001	0.11	1, 106	*ns*	0.6	0.00005
+ Coronary-Prone Behavior Pattern x Window Area	.175	.029	3.65	1, 105	<.06	16.6	0.00002*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 5.55$, $p < .001$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .10$. ** $p < .01$.

Table 15

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Amount of Window Area in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	54.3	0.03369*
+ Coronary-Prone Behavior Pattern	.072	.003	0.35	1, 107	*ns*	2.4	0.00075
+ Window Area	.078	.006	0.75	1, 106	*ns*	4.7	-0.00015
+ Coronary-Prone Behavior Pattern x Window Area	.127	.049	5.86	1, 105	<.02	38.6	0.00003*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 3.81, p < .01$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .05$.

Table 16

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Amount of Window Area in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Coronary-Prone Behavior Pattern	.011	.011	1.23	1, 108	*ns*	78.6	-0.01312
+ Window Area	.012	.001	0.05	1, 107	*ns*	7.1	-0.00036
+ Coronary-Prone Behavior Pattern x Window Area	.014	.002	0.22	1, 106	*ns*	14.3	-0.00006

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(3, 106) = .49$, *ns.*

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

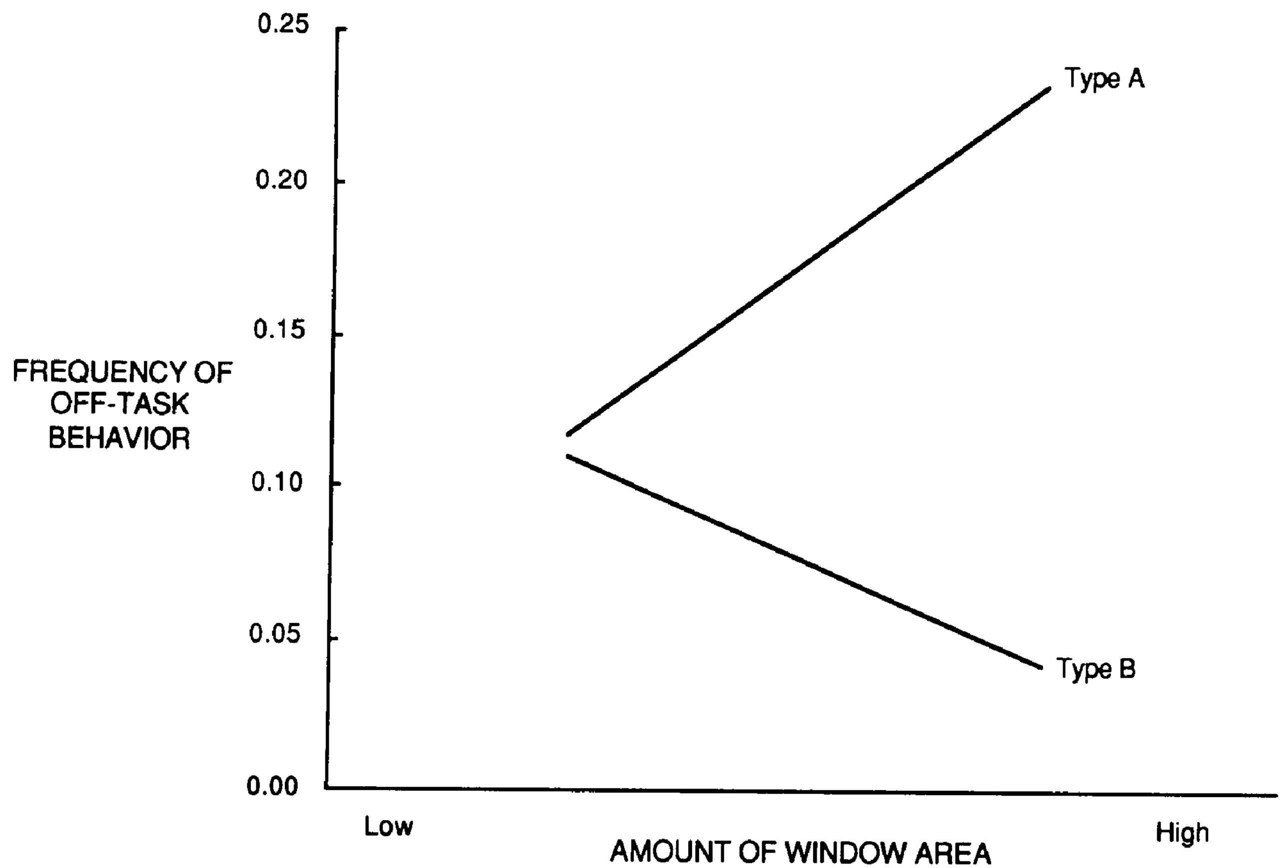

Figure 8. The relation between amount of classroom window area and task inattention for Type A (1 *SD*) and Type B (-1 *SD*) levels of coronary-prone behavior pattern. (The Frequency of Off-Task Behavior scale shows adjusted scores derived from the regression coefficients in Table 14.)

students showing low inattentiveness. The effect of window area was somewhat more pronounced for Type As.

Figure 9 shows the relations between window area and fidgeting for Type A and Type B students, determined from the regression coefficients in Table 15. As with task inattention, Type As and Type Bs differed most conspicuously in their observed frequency of fidgeting behavior at higher levels of fenestration, Type A students showing more restlessness than Type B students. Furthermore, in classrooms where the amount of window area was toward the lower end of the sampled range, Type Bs exhibited more fidgeting activity than Type As, although this difference was much less marked.

Desk Arrangement

As shown in Tables 17, 18, 19, and 20, the multiplicative model involving coronary-prone behavior pattern and desk arrangement explained a significant proportion of the variance in absenteeism, task inattention, and fidgeting, but not in cooperativeness. Type of seating arrangement (rows versus clusters) was not a significant predictor of any of these outcome measures. The predicted interaction between this classroom factor and coronary-prone behavior pattern, however, was found to be highly significant for task inattention, $F(1, 105)=8.39$, $p<.005$, and fidgeting, $F(1, 105)=7.31$, $p<.008$, and moderately significant for absenteeism, $F(1, 104)=3.62$, $p<.06$. The proportion of explained variance accounted for by the interaction term in the each of these analyses was as follows: for absenteeism, 18.5 percent; for task inattention, 29.4 percent; and for fidgeting, 38.6 percent.

An examination of the patterns of the three significant interaction effects revealed that each respective pair of regression lines intersected within the research range of interest. For absenteeism, the disordinal interaction between coronary-prone behavior pattern and desk arrangement (as determined from the regression coefficients in Table 17) is shown in Figure 10. Clustered seating was associated

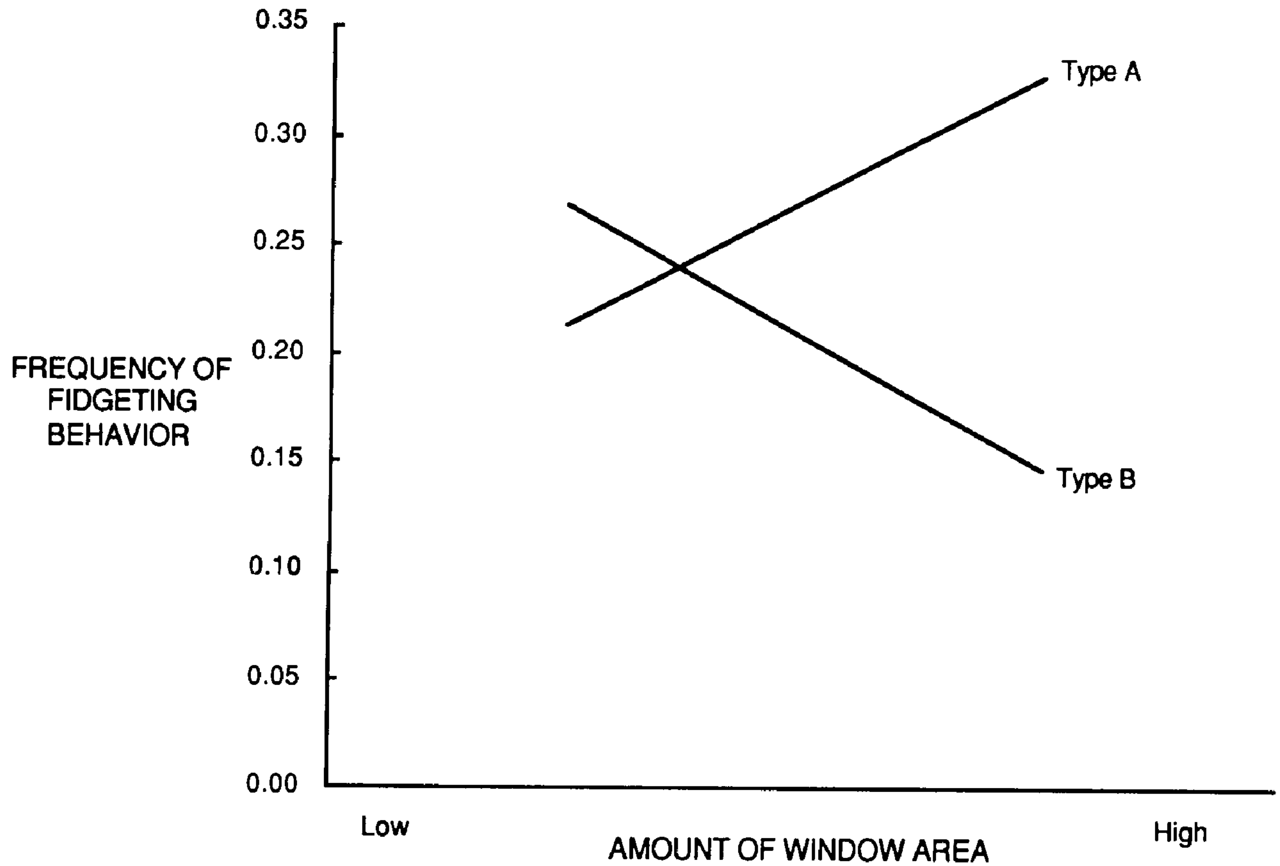

Figure 9. The relation between amount of classroom window area and fidgeting for Type A (1 *SD*) and Type B (-1 *SD*) levels of coronary-prone behavior pattern. (The Frequency of Fidgeting Behavior scale shows adjusted scores derived from the regression coefficients in Table 15.)

Table 17

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Type of Desk Arrangement in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	<.04	46.5	-0.15388**
Affiliation			2.76	1, 107	<.10		-0.16230*
+ Coronary-Prone Behavior Pattern	.122	.049	5.91	1, 106	<.02	31.2	-0.01562**
+ Desk Arrangement	.128	.006	0.75	1, 105	*ns*	3.8	0.12240
+ Coronary-Prone Behavior Pattern x Desk Arrangement	.157	.029	3.62	1, 104	<.06	18.5	-0.02473*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 3.88$, $p < .01$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .10$. ** $p < .05$.

Table 18

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Type of Desk Arrangement in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	51.9	-0.04271**
+ Coronary-Prone Behavior Pattern	.145	.034	4.24	1, 107	<.05	15.9	0.00199*
+ Desk Arrangement	.151	.006	0.78	1, 106	*ns*	2.8	-0.02052
+ Coronary-Prone Behavior Pattern x Desk Arrangement	.214	.063	8.39	1, 105	<.005	29.4	-0.00566**

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 7.14$, $p < .001$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .05$. ** $p < .01$.

Table 19

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Type of Desk Arrangement in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	45.1	0.04264*
+ Coronary-Prone Behavior Pattern	.072	.003	0.35	1, 107	*ns*	2.0	0.00084
+ Desk Arrangement	.094	.022	2.57	1, 106	*ns*	14.4	0.05026
+ Coronary-Prone Behavior Pattern x Desk Arrangement	.153	.059	7.31	1, 105	<.008	38.6	-0.00699*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105)=4.73$, $p<.01$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p<.01$.

Table 20

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Type of Desk Arrangement in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Coronary-Prone Behavior Pattern	.011	.011	1.23	1, 108	*ns*	50.0	-0.01292
+ Desk Arrangement	.020	.009	1.00	1, 107	*ns*	40.9	0.29739
+ Coronary-Prone Behavior Pattern x Desk Arrangement	.022	.002	0.16	1, 106	*ns*	9.1	-0.00978

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(3, 106) = .79$, *ns*.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

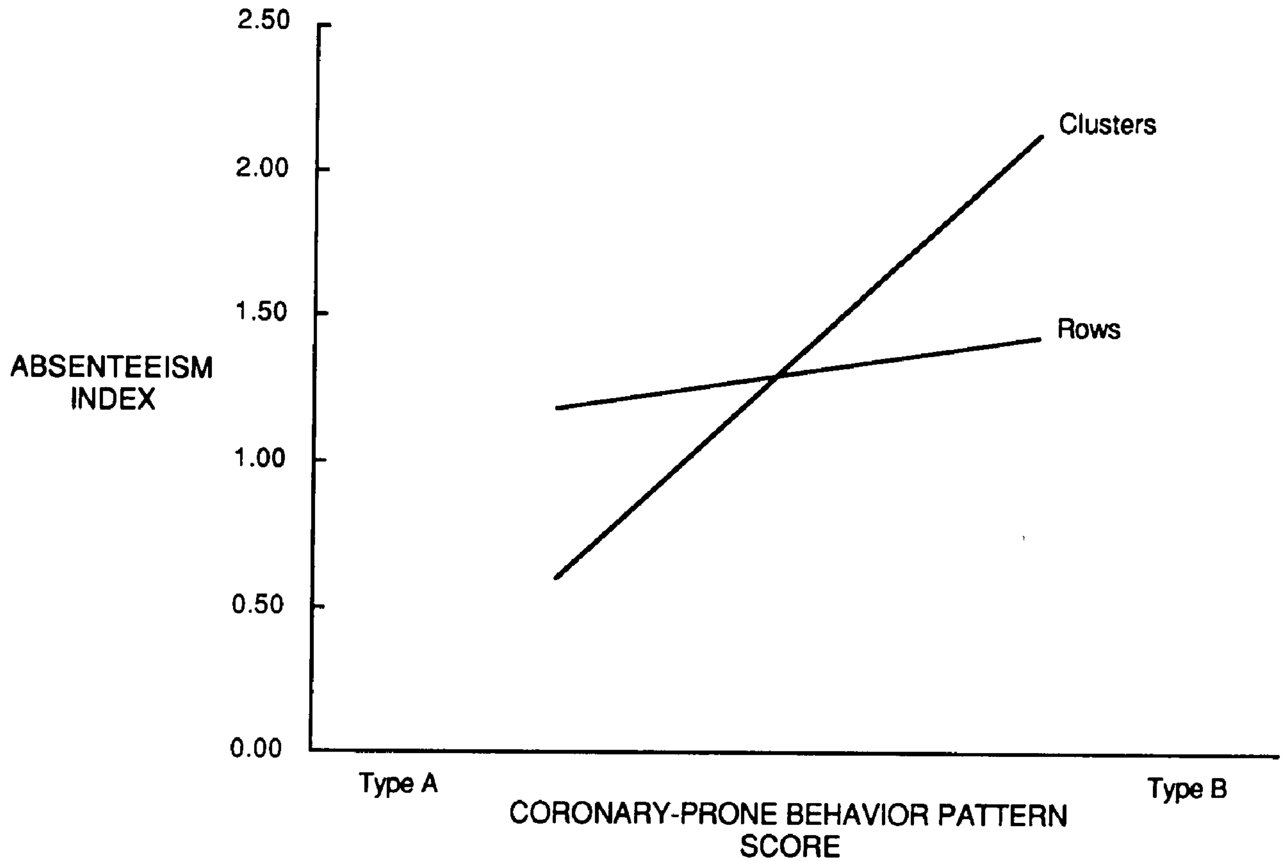

Figure 10. The relation between coronary-prone behavior pattern and absenteeism for row and cluster desk arrangements. (The Absenteeism scale shows adjusted scores derived from the regression coefficients in Table 17.)

with low levels of absenteeism in extreme Type A students and high levels of absenteeism in extreme Type B students. In contrast, when desks were arranged in rows, Type As showed higher levels of absenteeism, whereas Type Bs showed lower levels; the differences in absenteeism between Type A and Type B students in these conditions, however, were not strongly marked. The highest levels of absenteeism were for Type Bs seated in clustered desk arrangements. The crossover point of the regression lines occurred at a moderate level of coronary-prone behavior pattern, indicating that for students rated near the midpoint, the two types of seating configurations were equally related to attendance.

Figure 11 shows the disordinal interaction between coronary-prone behavior pattern and desk arrangement for task inattention. It can be seen that seating in rows was associated with high levels of inattentiveness in extreme Type A students and low levels of inattentiveness in extreme Type B students; clustered workstation arrangements, on the other hand, were identified with less frequent episodes of off-task behavior in Type As and higher levels of task inattention in Type Bs. Differences between Type A and Type B students were most evident in row seating conditions. Extreme Type A children seated in rows demonstrated the highest levels of task inattention within the classrooms sampled. As with absenteeism, the point at which the two regression lines for task inattention intersect occurred at a moderate level of coronary-prone behavior pattern.

The disordinal interaction between coronary-prone behavior pattern and desk arrangement for fidgeting is shown in Figure 12. (The regression coefficients shown in Table 19 were used to determine the regression equation.) The effect of seating configuration was strongly marked for both Type A and Type B students. In a manner similar for absenteeism and task inattention, Type As showed higher levels of fidgeting when desks were arranged in rows than when seating was clustered, whereas for Type Bs the tendency was in the opposite direction. Differences in restlessness between Type A and Type B students also were quite

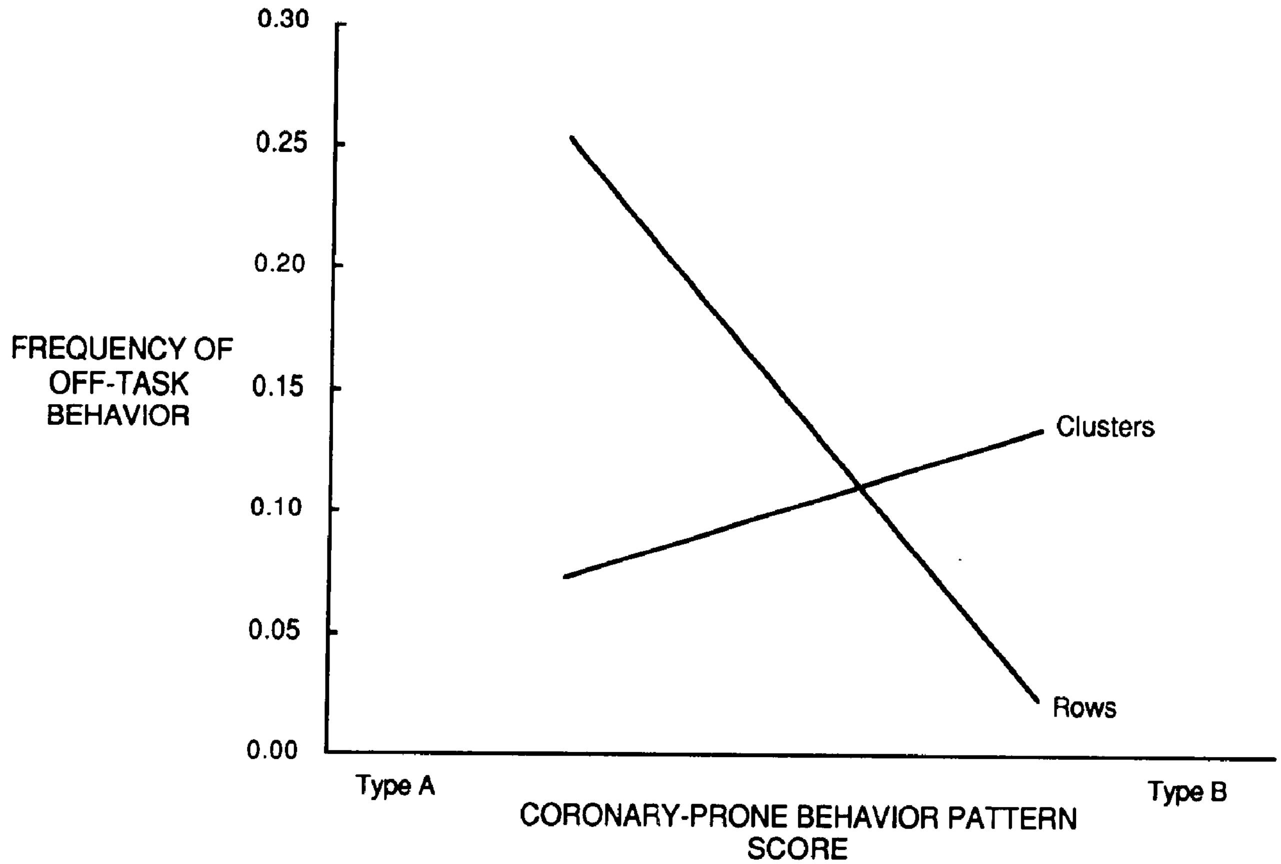

Figure 11. The relation between coronary-prone behavior pattern and task inattention for row and cluster desk arrangements. (The Frequency of Off-Task Behavior scale shows adjusted scores derived from the regression coefficients in Table 18.)

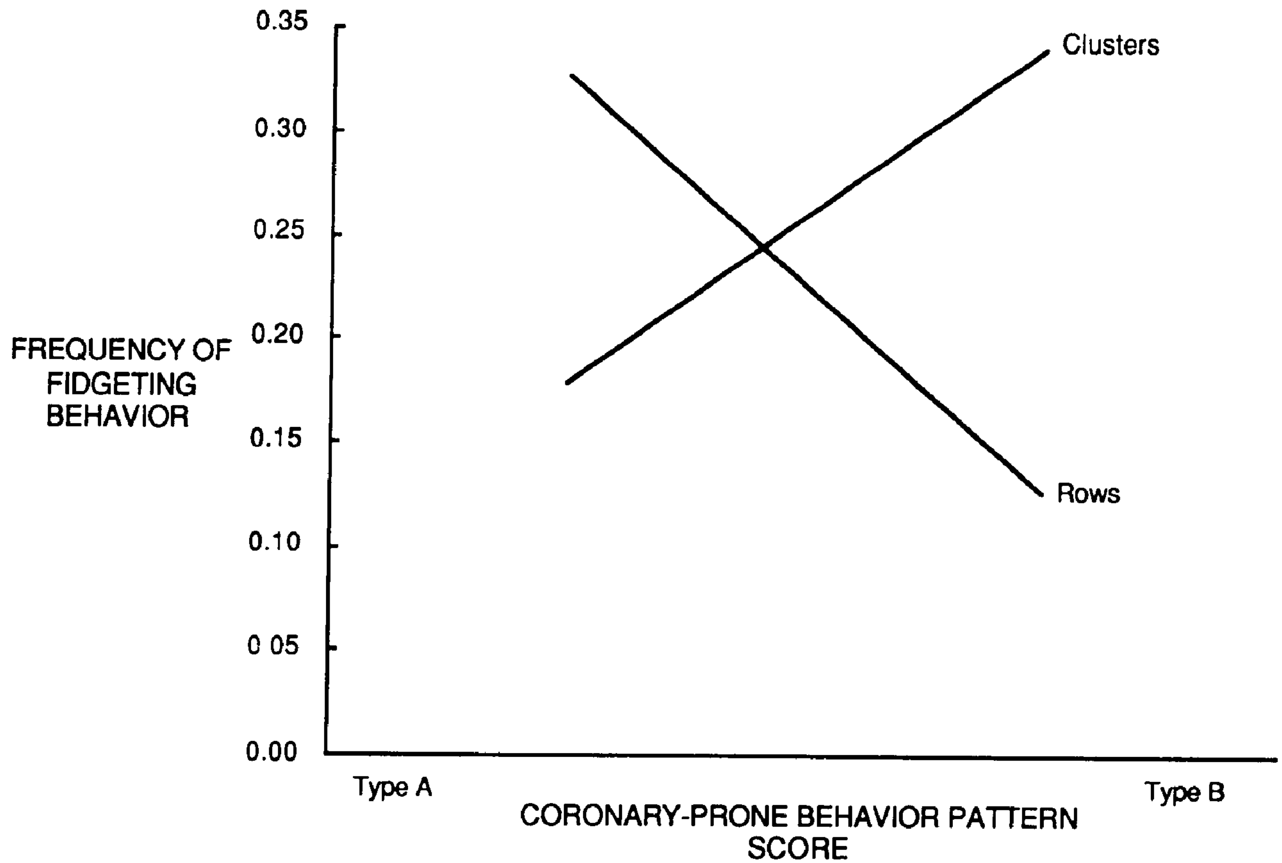

Figure 12. The relation between coronary-prone behavior pattern and fidgeting for row and cluster desk arrangements. (The Frequency of Fidgeting Behavior scale shows adjusted scores derived from the regression coefficients in Table 19.)

prominent for both types of seating configurations. Again, the crossover point of the regression lines occurred at a moderate level of coronary-prone behavior pattern.

Secluded Study Space

Coronary-prone behavior pattern, the availability of secluded study space, and the interaction between these two variables, expressed as a product term, were components in the regression analyses shown in Tables 21, 22, 23, and 24. The multiplicative model explained a significant proportion of the variance for absenteeism, task inattention, and fidgeting; as in the previous analyses, the predictive model failed to reach significance for cooperativeness. As a main factor, secluded study space was a significant overall predictor of fidgeting only. In addition, the analyses confirmed that two of the predicted interactions, reflecting the combined influence of coronary-prone behavior pattern and secluded study space on task inattention and fidgeting, were highly significant when entered after their component terms in the hierarchical analyses, $F(1, 105)=9.94$, $p<.003$, and $F(1, 105)=10.14$, $p<.002$, respectively. The predicted Coronary-Prone Behavior Pattern x Secluded Study Space interaction for absenteeism, however, was not significant. The interaction across levels accounted for 30.9 percent of the total explained variance in task attention and 38.8 percent in fidgeting.

For task inattention, Figure 13 shows the interaction between coronary-prone behavior pattern and secluded study space, determined from the regression coefficients in Table 22. The presence of discrete areas where students could go and work apart from the rest of the class was associated with high levels of inattentiveness in extreme Type A students and low levels of inattentiveness in extreme Type B students. In contrast, when such spaces were absent, Type As showed lower levels of task inattention and Types Bs showed higher levels; the availability of secluded study space appears to have had a more pronounced effect

Table 21

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Presence of Secluded Study Space in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	<.04	55.7	-0.13164
Affiliation			2.76	1, 107	<.10		-0.14227*
+ Coronary-Prone Behavior Pattern	.122	.049	5.91	1, 106	<.02	37.4	-0.01553**
+ Secluded Study Space	.122	.000	0.03	1, 105	*ns*	0.0	-0.05823
+ Coronary-Prone Behavior Pattern x Secluded Study Space	.131	.009	1.03	1, 104	*ns*	6.9	0.01377

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 3.13, p < .025$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .10$. ** $p < .05$.

Table 22

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Presence of Secluded Study Space in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	47.6	-0.04136**
+ Coronary-Prone Behavior Pattern	.145	.034	4.24	1, 107	<.05	14.6	0.00222*
+ Secluded Study Space	.161	.016	1.99	1, 106	*ns*	6.9	0.03660
+ Coronary-Prone Behavior Pattern x Secluded Study Space	.233	.072	9.94	1, 105	<.003	30.9	0.00617**

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 7.98$, $p < .001$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .05$. ** $p < .01$.

Table 23

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Presence of Secluded Study Space in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	34.3	0.08260**
+ Coronary-Prone Behavior Pattern	.072	.003	0.35	1, 107	*ns*	1.5	0.00067
+ Secluded Study Space	.123	.051	6.26	1, 106	<.02	25.4	-0.11851*
+ Coronary-Prone Behavior Pattern x Secluded Study Space	.201	.078	10.14	1, 105	<.002	38.8	0.00825*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 6.59$, $p < .001$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .01$. ** $p < .001$.

Table 24

Hierarchical Regression Analysis of Coronary-Prone Behavior Pattern and Presence of Secluded Study Space in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Coronary-Prone Behavior Pattern	.011	.011	1.23	1, 108	*ns*	42.3	-0.01347
+ Secluded Study Space	.014	.003	0.25	1, 107	*ns*	11.5	0.14422
+ Coronary-Prone Behavior Pattern x Secluded Study Space	.026	.012	1.34	1, 106	*ns*	46.2	-0.02933

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(3, 106) = .94$, *ns*.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

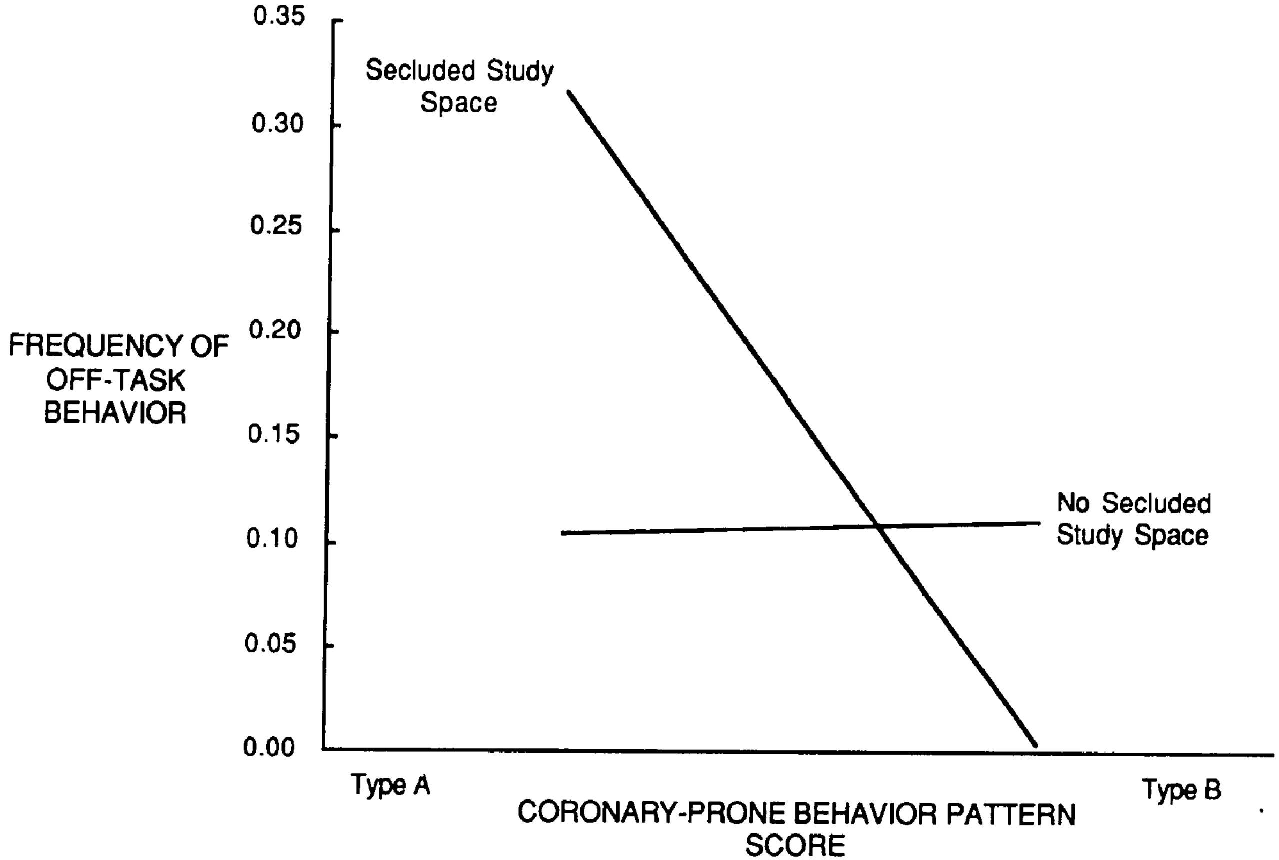

Figure 13. The relation between coronary-prone behavior pattern and task inattention for the presence and absence of secluded study space. (The Frequency of Off-Task Behavior scale shows adjusted scores derived from the regression coefficients in Table 22.)

on task inattention for Type As. Differences between Type A and Type B students in their frequency of off-task behavior were negligible when secluded study space was absent.

The interaction between coronary-prone behavior pattern and secluded study space for fidgeting is shown in Figure 14. (The regression equation was determined from the regression coefficients in Table 23.) Type A students demonstrated high levels of restlessness when isolated study areas were available to the class, but this was also true for Type B students when secluded study space was not available. Conversely, less frequent episodes of fidgeting behavior were observed for Type As in the absence of secluded study space and for Type Bs when such space was present. The effect of secluded study space on fidgeting was more strongly marked for Type B students.

Arousal-Seeking Tendency

Analyses related to the second individual difference measure, arousal-seeking tendency, were carried out in a manner identical to those involving coronary-prone behavior pattern. That is, for the four outcome measures (absenteeism, task inattention, fidgeting, and cooperativeness), the predicted interaction models were tested by including the appropriate product terms in hierarchical regression analyses. For each analysis, the covariates (if any), the measure of arousal-seeking tendency, and one of the five classroom variables were entered hierarchically, in that order, followed by the product term representing the interaction between the component main factors. In addition, regression coefficients derived from the final predictive equations (in which each term was corrected for all other terms) were used to examine the nature of significant interaction effects for the outcome measures.

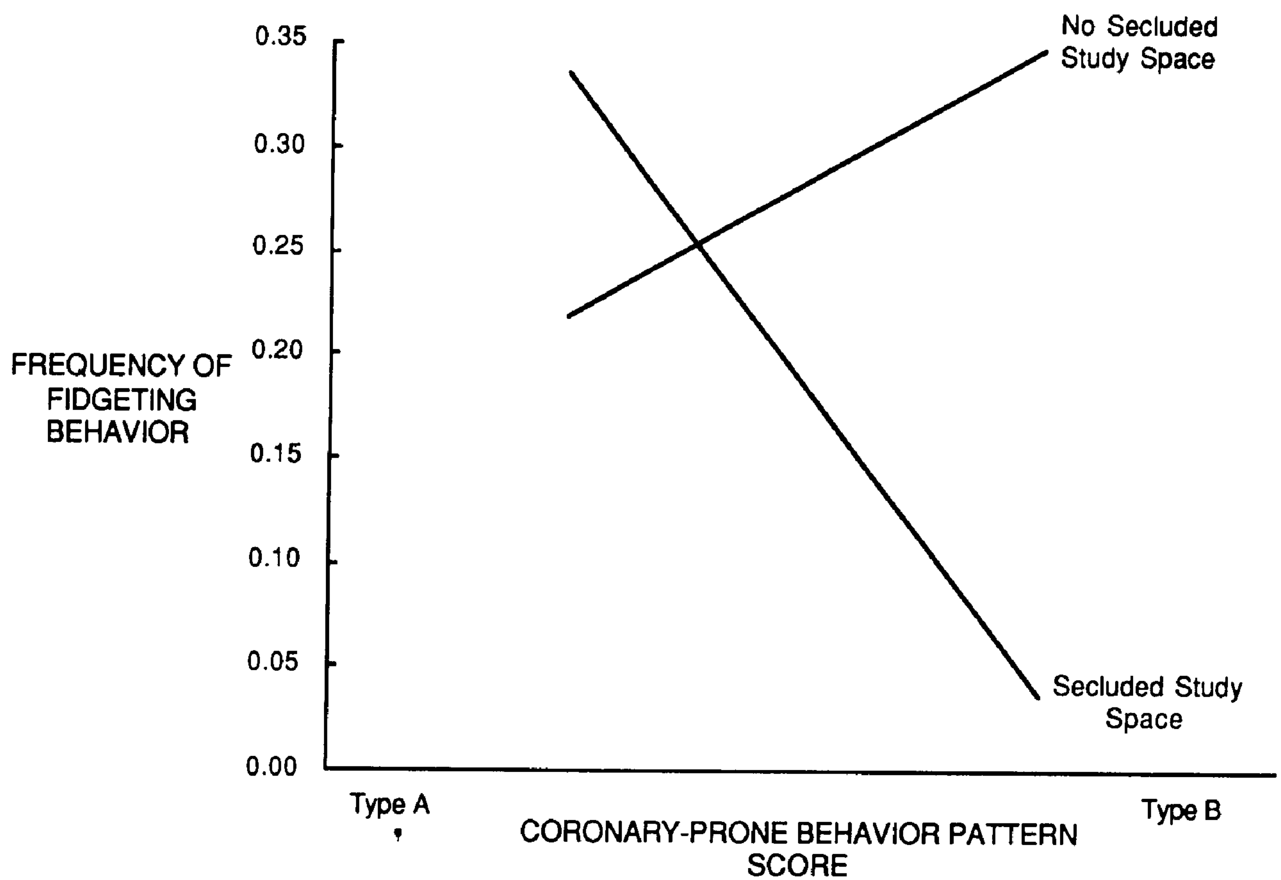

Figure 14. The relation between coronary-prone behavior pattern and fidgeting for the presence and absence of secluded study space. (The Frequency of Fidgeting Behavior scale shows adjusted scores derived from the regression coefficients in Table 23.)

Classroom Density

Hierarchical regression analyses involving arousal-seeking tendency and classroom density are shown in Tables 25, 26, 27, and 28. The multiplicative model explained a significant proportion of the variance in task inattention, fidgeting, and cooperativeness; the predictive model, however, failed to reach significance for absenteeism. As a main factor, arousal-seeking tendency was a significant overall predictor of cooperativeness scores. Density (quadratic term) was also a significant predictor of task inattention. In addition, the interaction between arousal-seeking tendency and the linear component of density was significant for cooperativeness, $F(1, 105) = 6.38$, $p < .02$, when entered hierarchically after the main factors; the predicted curvilinear interaction was not significant. The interactions across levels accounted for 61.2 percent of the total explained variance in cooperativeness.

Figure 15 shows the relations between classroom density and cooperativeness for high (1 *SD* above the mean) and low (1 *SD* below the mean) levels of arousal-seeking tendency. (The regression coefficients in Table 28 were used to determine the regression equation.) It can be seen that marked differences in cooperative attitudes between high- and low-arousal-seeking students occurred only at lower levels of classroom density, high-arousal-seekers reporting a higher degree of cooperativeness than low-arousal-seekers. For low-arousal-seekers, the tendency was for cooperativeness to increase with increases in density (although a small decrease in cooperativeness is discernible at the higher end of the sample's density range); for high-arousal-seekers, the effect of density was less marked. (The above finding for cooperativeness should be viewed cautiously since none of the regression coefficients shown in Table 28 is significantly different from zero, despite a significant squared multiple correlation for the full equation. It is possible that correlations between the independent variables resulted in a substantial inflation of the variances of the regression coefficients and the sum of squares attributable to each variable.)

Table 25

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Classroom Density in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	< .04	88.0	-0.18587
Affiliation			2.76	1, 107	< .10		-0.14600
+ Arousal-Seeking Tendency	.073	.000	0.02	1, 106	*ns*	0.0	-0.00537
+ Density (linear)	.075	.002	0.28	1, 105	*ns*	2.4	0.00765
+ Density (quadratic)	.076	.001	0.02	1, 104	*ns*	1.2	-0.00007
+ Arousal-Seeking Tendency x Density (linear)	.079	.003	0.34	1, 103	*ns*	3.6	-0.00411
+ Arousal-Seeking Tendency x Density (quadratic)	.083	.004	0.37	1, 102	*ns*	4.8	0.00012

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(7, 102) = 1.31$, *ns*.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

Table 26

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Classroom Density in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	58.1	-0.04062**
+ Arousal-Seeking Tendency	.122	.011	1.40	1, 107	*ns*	5.8	-0.00374
+ Density (linear)	.142	.020	2.43	1, 106	*ns*	10.5	-0.00309
+ Density (quadratic)	.177	.035	4.45	1, 105	<.04	18.3	0.00027*
+ Arousal-Seeking Tendency x Density (linear)	.191	.014	1.77	1, 104	*ns*	7.3	-0.00049
+ Arousal-Seeking Tendency x Density (quadratic)	.191	.000	0.02	1, 103	*ns*	0.0	0.00000

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(6, 103) = 4.05, p < .01$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .05$. ** $p < .01$.

Table 27

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Classroom Density in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	64.5	0.02685
+ Arousal-Seeking Tendency	.083	.014	1.68	1, 107	*ns*	13.1	0.00502
+ Density (linear)	.103	.020	2.41	1, 106	*ns*	18.7	0.00514
+ Density (quadratic)	.105	.002	0.21	1, 105	*ns*	1.9	-0.00008
+ Arousal-Seeking Tendency x Density (linear)	.107	.002	0.22	1, 104	*ns*	1.9	-0.00001
+ Arousal-Seeking Tendency x Density (quadratic)	.107	.000	0.04	1, 103	*ns*	0.0	-0.00001

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(6, 103) = 2.07, p < .10$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

Table 28

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Classroom Density in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Arousal-Seeking Tendency	.040	.040	4.53	1, 108	<.04	34.5	0.03116
+ Density (linear)	.040	.000	0.02	1, 107	*ns*	0.0	0.01914
+ Density (quadratic)	.045	.005	0.52	1, 106	*ns*	4.3	-0.00134
+ Arousal-Seeking Tendency x Density (linear)	.100	.055	6.38	1, 105	<.02	47.4	-0.00199
+ Arousal-Seeking Tendency x Density (quadratic)	.116	.016	1.94	1, 104	ns	13.8	0.00049

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 2.74, p < .025$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

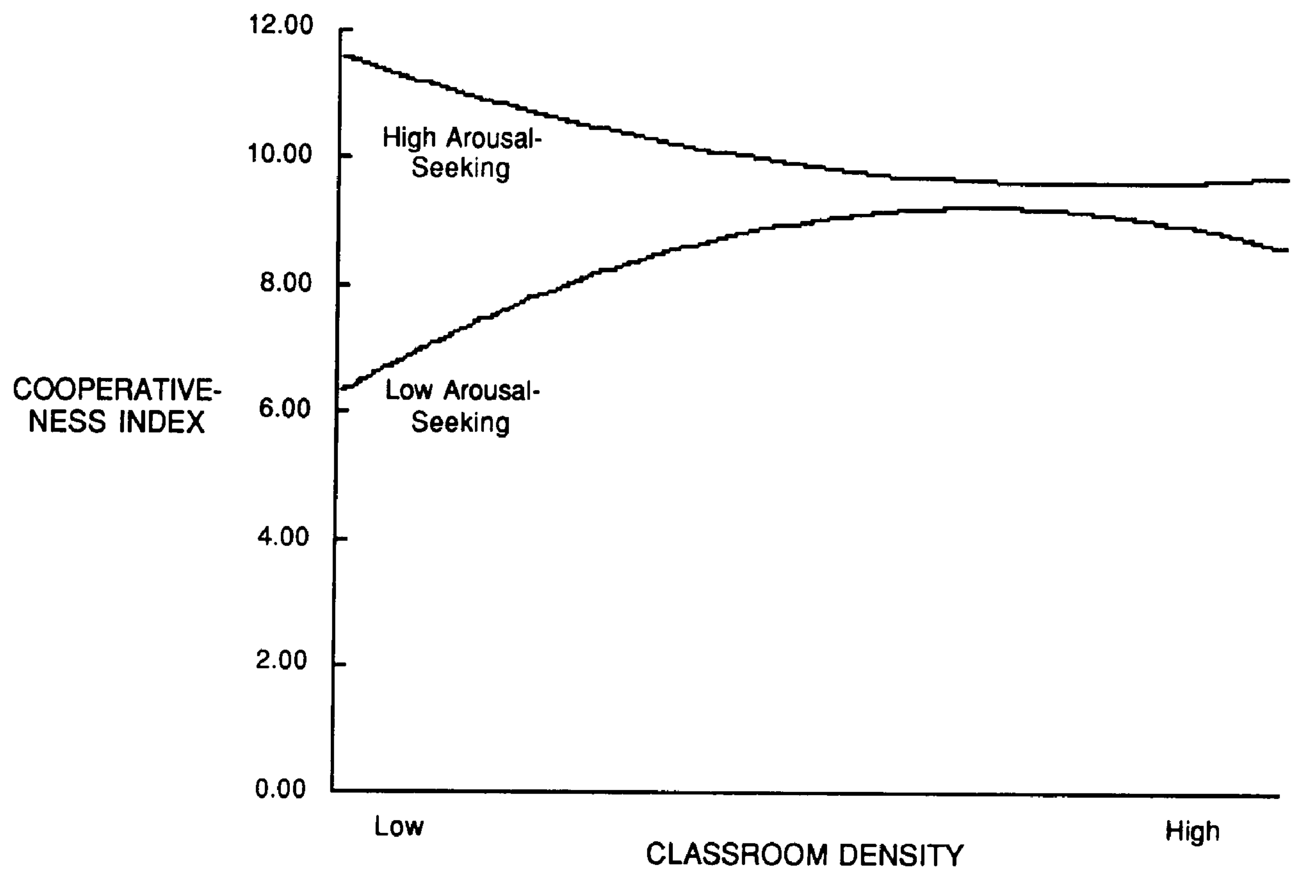

Figure 15. The relation between classroom density and cooperativeness for high (1 *SD*) and low (-1 *SD*) levels of arousal-seeking tendency. (The Cooperativeness Index scale shows adjusted scores derived from the regression coefficients in Table 28.)

Openness of Classroom Perimeter

As shown in Tables 29, 30, 31, and 32, the predictive interaction model involving arousal-seeking tendency and openness of classroom perimeter explained a significant proportion of the variance in all four of the outcome measures. Openness was highly significant as a predictor of fidgeting only. In addition, the analyses confirmed that one of the predicted interactions, reflecting the combined influence of arousal-seeking tendency and openness of perimeter on cooperativeness, was highly significant when entered after the constituent terms in the hierarchical analysis, $F(1, 106) = 10.28, p < .002$. The interaction accounted for 67.5 percent of the total explained variance in cooperativeness.

The interaction between arousal-seeking tendency and openness of classroom perimeter for cooperativeness (determined from the regression coefficients in Table 32) is shown in Figure 16. For high-arousal-seeking students, cooperativeness increased as the percentage of the classroom perimeter characterized by open space increased; in contrast, for low-arousal-seeking students, cooperativeness scores decreased with increases in openness. Differences in cooperative attitudes between high- and low-arousal-seekers were most evident at higher levels of openness, and the overall level of cooperativeness was generally higher for students who preferred arousal-eliciting situations.

Amount of Window Area

Analyses of the outcome measures, shown in Tables 33, 34, 35, and 36, confirmed that the multiplicative model involving arousal-seeking tendency and classroom window area explained a significant proportion of the variance in absenteeism, task inattention, and fidgeting, but not in cooperativeness. As a main factor, amount of window area was not a significant predictor of any of the outcome measures. Furthermore, none of the predicted interactions between arousal-seeking tendency and window area (entered hierarchically after the

Table 29

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Openness of Classroom Perimeter in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	<.04	85.9	-0.14657*
Affiliation			2.76	1, 107	<.10		-0.14472*
+ Arousal-Seeking Tendency	.073	.000	0.02	1, 106	*ns*	0.0	-0.00028
+ Openness of Perimeter	.084	.011	1.29	1, 105	*ns*	12.9	0.00453
+ Arousal-Seeking Tendency x Openness of Perimeter	.085	.001	0.08	1, 104	*ns*	1.2	-0.00027

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 1.93$, $p < .10$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .10$.

Table 30

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Openness of Classroom Perimeter in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	76.0	-0.04842*
+ Arousal-Seeking Tendency	.122	.011	1.40	1, 107	*ns*	7.5	-0.00413
+ Openness of Perimeter	.137	.015	1.83	1, 106	*ns*	10.3	0.00089
+ Arousal-Seeking Tendency x Openness of Perimeter	.146	.009	1.03	1, 105	*ns*	6.2	-0.00015

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 4.48$, $p < .01$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .001$.

Table 31

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Openness of Classroom Perimeter in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	40.6	0.04666*
+ Arousal-Seeking Tendency	.083	.014	1.68	1, 107	*ns*	8.2	0.00329
+ Openness of Perimeter	.166	.083	10.58	1, 106	<.002	48.8	0.00247*
+ Arousal-Seeking Tendency x Openness of Perimeter	.170	.004	0.47	1, 105	*ns*	2.4	-0.00013

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 5.38, p < .001$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .01$.

Table 32

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Openness of Classroom Perimeter in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Arousal-Seeking Tendency	.040	.040	4.53	1, 108	<.04	31.7	0.08894*
+ Openness of Perimeter	.041	.001	0.06	1, 107	*ns*	0.8	-0.00178
+ Arousal-Seeking Tendency x Openness of Perimeter	.126	.085	10.28	1, 106	<.002	67.5	0.00545*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(3, 106) = 5.08, p < .01$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .01$.

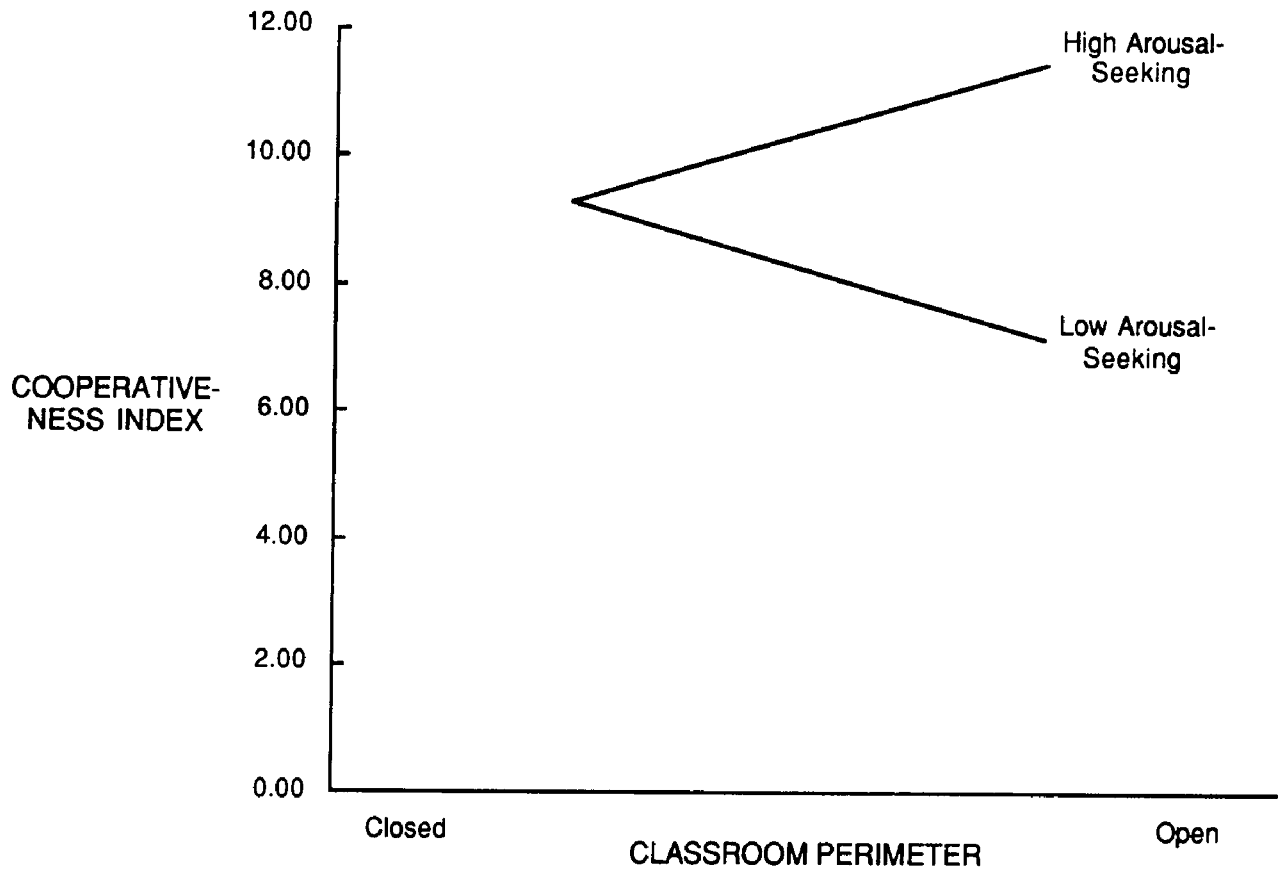

Figure 16. The relation between openness of classroom perimeter and cooperativeness for high (1 *SD*) and low (-1 *SD*) levels of arousal-seeking tendency. (The Cooperativeness Index scale shows adjusted scores derived from the regression coefficients in Table 32.)

Table 33

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Amount of Window Area in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	<.04	85.9	-0.18771**
Affiliation			2.76	1, 107	<.10		-0.15458*
+ Arousal-Seeking Tendency	.073	.000	0.02	1, 106	*ns*	0.0	0.00176
+ Window Area	.085	.012	1.40	1, 105	*ns*	14.1	-0.00106
+ Arousal-Seeking Tendency x Window Area	.085	.000	0.01	1, 104	*ns*	0.0	0.00002

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 1.94, p < .10$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .10$. ** $p < .05$.

Table 34

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Amount of Window Area in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	89.5	-0.04395*
+ Arousal-Seeking Tendency	.122	.011	1.40	1, 107	*ns*	8.9	-0.00338
+ Window Area	.124	.002	0.21	1, 106	*ns*	1.6	0.00006
+ Arousal-Seeking Tendency x Window Area	.124	.000	0.04	1, 105	*ns*	0.0	-0.00001

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 3.73$, $p < .01$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .01$.

Table 35

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Amount of Window Area in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	74.2	0.03803*
+ Arousal-Seeking Tendency	.083	.014	1.68	1, 107	*ns*	15.1	0.00515
+ Window Area	.088	.005	0.61	1, 106	*ns*	5.4	-0.00014
+ Arousal-Seeking Tendency x Window Area	.093	.005	0.49	1, 105	*ns*	5.4	-0.00003

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 2.68$, $p < .05$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .05$.

Table 36

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Amount of Window Area in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Arousal-Seeking Tendency	.040	.040	4.53	1, 108	$<.04$	76.9	0.07830*
+ Window Area	.041	.001	0.09	1, 107	*ns*	1.9	-0.00041
+ Arousal-Seeking Tendency x Window Area	.052	.011	1.27	1, 106	*ns*	21.2	-0.00038

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(3, 106) = 1.95$, *ns*.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .05$.

constituent terms) was found to be significant. In analyses of absenteeism, task inattention, and fidgeting scores, the interaction across levels accounted for an average of only 1.8 percent of the total explained variance.

Desk Arrangement

As shown in Tables 37, 38, 39, and 40, the multiplicative model involving arousal-seeking tendency and desk arrangement explained a significant proportion of the variance in task inattention, fidgeting, and cooperativeness, but failed to do so for absenteeism. Type of seating arrangement (rows versus clusters) was not a significant predictor of any of these outcome measures. The predicted interaction between this classroom factor and arousal-seeking tendency, however, was found to be significant for cooperativeness when entered hierarchically after the main factor terms, $F(1, 106)=3.08, p<.09$. The interaction for cooperativeness accounted for 36.5 percent of the explained variance.

Figure 17 shows the relation between arousal-seeking tendency and cooperativeness for row and cluster desk arrangements. (The regression equation was determined from the coefficients in Table 40.) For clustered seating, the tendency was for cooperativeness to increase with increases in arousal-seeking scores. In contrast, when desks were arranged in rows, differences in cooperative attitudes between high- and low-arousal-seekers were negligible. The highest levels of cooperativeness were reported by high-arousal-seeking students seated in clustered desk arrangements; furthermore, the effect of desk arrangement on cooperativeness was slightly more pronounced for these students than for students scoring low on the arousal-seeking scale.

Secluded Study Space

Tables 41, 42, 43, and 44 show the results of regression analyses involving arousal-seeking tendency, the availability of secluded study space, and the

Table 37

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Type of Desk Arrangement in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	<.04	91.3	-0.14810*
Affiliation			2.76	1, 107	<.10		-0.17169*
+ Arousal-Seeking Tendency	.073	.000	0.02	1, 106	*ns*	0.0	0.00232
+ Desk Arrangement	.080	.007	0.75	1, 105	*ns*	8.8	0.15580
+ Arousal-Seeking Tendency x Desk Arrangement	.080	.000	0.05	1, 104	*ns*	0.0	0.00927

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 1.81$, *ns*.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .10$.

Table 38

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Type of Desk Arrangement in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	86.7	-0.03949*
+ Arousal-Seeking Tendency	.122	.011	1.40	1, 107	*ns*	8.6	-0.00336
+ Desk Arrangement	.128	.006	0.67	1, 106	*ns*	4.7	-0.02265
+ Arousal-Seeking Tendency x Desk Arrangement	.128	.000	0.04	1, 105	*ns*	0.0	0.00120

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 3.86, p < .01$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .05$.

Table 39

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Type of Desk Arrangement in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	65.7	0.04298*
+ Arousal-Seeking Tendency	.083	.014	1.68	1, 107	*ns*	13.3	0.00487
+ Desk Arrangement	.101	.018	2.15	1, 106	*ns*	17.1	0.04620
+ Arousal-Seeking Tendency x Desk Arrangement	.105	.004	0.42	1, 105	*ns*	3.8	0.00511

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 3.08$, $p < .025$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .01$.

Table 40

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Type of Desk Arrangement in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Arousal-Seeking Tendency	.040	.040	4.53	1, 108	<.04	54.1	0.08243**
+ Desk Arrangement	.047	.007	0.81	1, 107	*ns*	9.5	0.24368
+ Arousal-Seeking Tendency x Desk Arrangement	.074	.027	3.08	1, 106	<.09	36.5	0.12552*

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(3, 106) = 2.83, p < .05$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .10$. ** $p < .05$

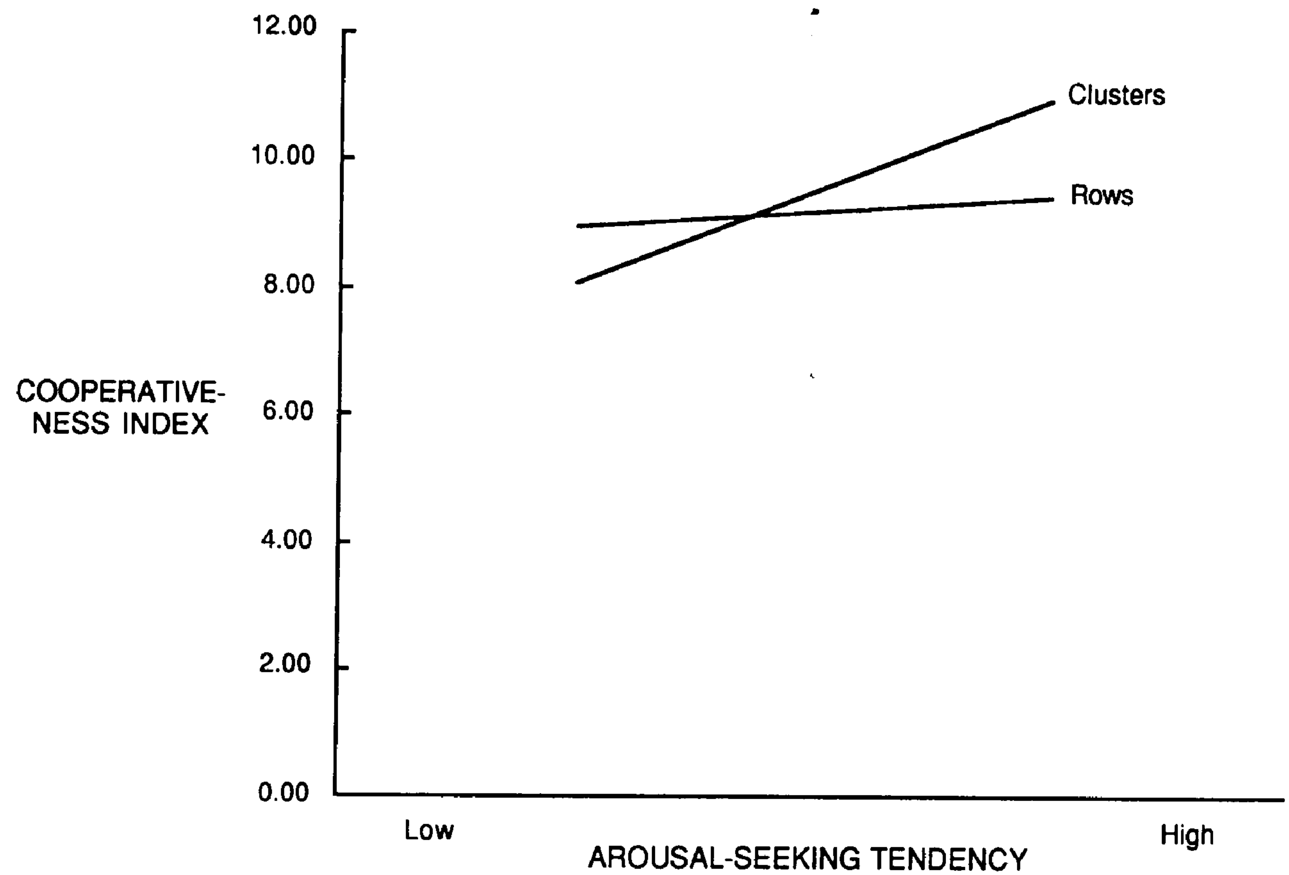

Figure 17. The relation between arousal-seeking tendency and cooperativeness for row and cluster desk arrangements. (The Cooperativeness Index scale shows adjusted scores derived from the regression coefficients in Table 40.)

Table 41

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Presence of Secluded Study Space in Relation to Absenteeism

Source	*Cumulative* R^2	R^2 increment	F	*df*	p	% of explained variance	B[a]
Rule Clarity	.073	.073	4.44	1, 107	< .04	100.0	-0.15153
Affiliation			2.76	1, 107	< .10		-0.13317
+ Arousal-Seeking Tendency	.073	.000	0.02	1, 106	*ns*	0.0	0.00278
+ Secluded Study Space	.073	.000	0.01	1, 105	*ns*	0.0	-0.01681
+ Arousal-Seeking Tendency x Secluded Study Space	.073	.000	0.03	1, 104	*ns*	0.0	-0.00657

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(5, 104) = 1.65$, *ns*.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

Table 42

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Presence of Secluded Study Space in Relation to Task Inattention

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Innovation	.111	.111	13.47	1, 108	<.0004	77.6	-0.04614*
+ Arousal-Seeking Tendency	.122	.011	1.40	1, 107	*ns*	7.7	-0.00342
+ Secluded Study Space	.133	.011	1.35	1, 106	*ns*	7.7	0.03022
+ Arousal-Seeking Tendency x Secluded Study Space	.143	.010	1.21	1, 105	*ns*	7.0	0.00627

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 4.39$, $p < .01$.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .01$.

Table 43

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Presence of Secluded Study Space in Relation to Fidgeting

Source	*Cumulative* R^2	R^2 increment	F	df	p	% of explained variance	B[a]
Rule Clarity	.069	.069	7.97	1, 108	<.006	51.5	0.07441**
+ Arousal-Seeking Tendency	.083	.014	1.68	1, 107	*ns*	10.4	0.00366
+ Secluded Study Space	.131	.048	5.86	1, 106	<.02	35.8	-0.10513*
+ Arousal-Seeking Tendency x Secluded Study Space	.134	.003	0.36	1, 105	*ns*	2.2	0.00440

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(4, 105) = 4.06, p < .01$.
[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.
* $p < .05$. ** $p < .001$.

Table 44

Hierarchical Regression Analysis of Arousal-Seeking Tendency and Presence of Secluded Study Space in Relation to Cooperativeness Scores

Source	*Cumulative* R^2	R^2 increment	*F*	*df*	*p*	% of explained variance	B[a]
Arousal-Seeking Tendency	.040	.040	4.53	1, 108	$<.04$	70.2	0.07024*
+ Secluded Study Space	.046	.006	0.63	1, 107	*ns*	10.5	0.25241
+ Arousal-Seeking Tendency x Secluded Study Space	.057	.011	1.24	1, 106	*ns*	19.3	0.07624

Note. Plus (+) indicates a new step in the hierarchical analysis. Overall significance of model: $F(3, 106) = 2.13$, *ns*.

[a] The B values are the unstandardized coefficients from the final regression equation, each term being corrected for all other terms.

* $p < .05$.

interaction between these two variables, expressed as a product term. The predictive model explained a significant proportion of the variance in task inattention and fidgeting, but failed to reach significance for absenteeism and cooperativeness. As a main factor, secluded study space was a significant overall predictor of fidgeting only. Contrary to predictions, none of the interactions between arousal-seeking tendency and secluded study space were significant when entered after their component terms in the hierarchical analyses. In analyses of task inattention and fidgeting scores, the interaction across levels accounted for only 7.0 percent and 2.2 percent of the total explained variance, respectively.

Notes

1. Cook and Campbell (1979) cited several reasons for this irony, including chance, selection differences in intact groups which influence data patterns but are irrelevant to theory, and theories that are partially or totally incorrect. Replication is required to control for chance fluctuations that may occur when making higher-order interaction predictions.

2. Students participating in the study, however, were randomly assigned to target and non-target groups.

3. There are, however, instances where categorization of a continuous variable is desirable. One notable example is in treatments-by-levels designs where the continuous variable is primarily a control variable. In this design the variable is blocked to form different levels; subjects are then randomly assigned from each level to each of the treatments. The levels are treated as distinct categories in a factorial analysis of variance. Introducing levels into the design decreases the error term, thereby enabling a more sensitive F test for the main effect to be obtained. The reduction in the error term, of course, depends on the correlation between the continuous variable and the dependent variable (cf. Pedhazur, 1982).

4. In other words, tested was $R^2_{Y.X,Z,XZ} - R^2_{Y.X,Z}$, where XZ represents the cross product of the X and Z vectors.

5. Finney et al. (1984) also advocated using the average-effect method for estimating main effects in the absence of a statistically significant interaction. They argued that there are important logical shortcomings to removing the product term and reverting to an additive model when an hypothesized interaction effect is not significant, in contrast to retaining the a priori multiplicative model and estimating average effects. First, failing to find a significant interaction effect does not

guarantee that exact homogeneity in regression slopes exists in the population. Second, in addition to reporting interactions that reach significance, investigators should describe those that do not since "*consistent* nonsignificant results are at least as valuable to a science as are incoherent significant results" (Cronbach & Snow, 1977, p. 53). For arguments supporting the use of additive model estimates, see Cramer and Appelbaum (1980).

6. In addition, deviation-score transformations in product-term regression analysis will reduce the product term's correlation with the constituent variables and have therefore been recommended as a cure for the multicollinearity problem often encountered with the use of raw scores (see e.g., Finney, Mitchell, Cronkite, & Moos, 1984).

7. For each classroom, the CES scores of the non-target students were averaged; this average score was then assigned to each of the target students in the classroom. It will be recalled from the Methods section that the intent of this approach was to define the psychosocial classroom environment in terms of the shared perceptions of the students within that environment, and yet independent of the target students' own perceptions of their classroom situation.

8. Data were incomplete for 26 of the 136 target students who participated in the study. The majority of these missing cases can be traced to two classes in which the teachers did not complete questionnaire ratings of the target students.

DISCUSSION

Certain behaviors indicative of dysfunctional coping are significantly related to individual differences and to physical characteristics of the classroom environment. Furthermore, this study on balance supports initial predictions that the interaction between these factors contributes significantly to the variance in the outcome measures. These findings will be examined later, along with various theoretical and methodological issues provoked by the study. First, however, several issues of causal inference and interpretation, introduced in the previous chapter, will be revisited.

It will be recalled that problems related to selection and construct validity are inherent in nonequivalent control group designs and that, due to these difficulties, causal inferences about relations between individual differences, classroom design factors, and behavior cannot be made unambiguously in the present study. First, the assignment of students to particular classroom environments was not under the control of the investigator, precluding the formation of probabilistically equivalent groups. Second, the possibility of one or more unmeasured variables influencing both individual difference scores and ratings on the outcome measures cannot be excluded. Third, in some instances individual differences were assessed subsequent to the measurement of the outcome variables (e.g., observation of fidgeting behaviors preceded the ratings of students on the MYTH by their teachers). Thus, relations between coronary-prone behavior pattern/arousal-seeking tendency and absenteeism, task inattention, fidgeting, and cooperativeness can be interpreted as the influence of individual differences on these behaviors, but are also open to interpretation in the opposite direction. While these threats are more plausible with respect to the main effects of individual differences on the outcome variables, they also may bias the estimates of the regression coefficients for the interaction terms. For example, parents may have chosen to enroll their children in particular classroom settings (e.g., open plan or traditional) because they expected these specific settings to have the most benefit for their children. This selection artifact has the effect of depressing the interaction estimates. It is unclear to what extent the present results are affected by such problems.

Interpretations involving the environmental variables likewise may be problematic. As is frequently the case in nonexperimental research, in the present study the classroom design factors are neither mutually exclusive nor independent. For example, classrooms characterized by a high level of open perimeter space also were likely to contain clustered desk arrangements (see Table 4). In some cases, this may be explained by the covariation of teaching practices. The basis of inference is different for the psychosocial environment measure. Assessed by responses on the Classroom Environment Scale and entered as a covariate in multiple regression analyses, the measure did not rely on self-report data in that the scores applied to each target student represented the consensus view of his or her peers within the same classroom, not the target student's own responses. Because participants in the study were randomly assigned into target and non-target groups, the peer ratings were derived from a random group of students whose classroom situation was essentially similar to that of the target student. While ensuring that the environmental measure was free from the self-report biases of the individual concerned, this approach cannot exclude the possibility that the CES scores applied to a particular target student might be indirectly affected by that individual's behavior and interactions with his or her peer group.

While the above problems caution against making unqualified inferences, the findings of the present study can still be linked to the corpus of classroom research. In addition, the present findings can provide direction for subsequent research in this area.

Empirical Findings

The main findings of the present study are summarized in Tables 45 and 46. Person and environmental variables were each found to be predictors of selective outcome measures. Reflecting the pressured drive (e.g., push for achievement) that is characteristic of the Type A behavior pattern (TABP), absenteeism was less frequent among Type A students than their more easygoing Type B counterparts. This finding is consistent with those of other studies that suggest a deficiency in the signaling process among Type A individuals that would alert them to fatigue and illness (cf. Carver, Coleman, & Glass, 1976; Matthews & Carra, 1982). Somewhat surprising, however, is the observation that Type As engaged in higher levels of off-task behavior. Type A individuals typically have been described as being hyperalert (see e.g., Bortner & Rosenman, 1967; Friedman & Rosenman, 1959; Rosenman & Friedman, 1961), with at least one study indicating that Type As actively inhibit or suppress their attention to task-irrelevant peripheral events that might distract them from task performance (Matthews & Brunson, 1979).

Arousal-seeking tendency was a major determinant of cooperativeness and was less relevant for absenteeism, task inattention, and fidgeting. As expected, students who scored higher on the arousal-seeking scale also expressed a stronger desire to work together with other students.

Three of the classroom design factors examined in the present study (density, openness of perimeter, and secluded study space) were found to contribute significantly to the explained variance in the scores for task inattention and fidgeting. Consistent with the Yerkes-Dodson law and previous findings suggesting that persons generally prefer moderate levels of stimulation in their environments (e.g., Berlyne, 1971; Fiske & Maddi, 1961; Wohlwill, 1974), the results show a curvilinear relation between density and task inattention. Task inattention was most frequent in highly crowded (27 square feet per student) and least crowded (64 square feet per student) classrooms, and least frequent in moderately crowded (about 35

Table 45

Coronary-Prone Behavior Pattern and Classroom Design Factors in Relation to Outcome Measures: Summary of Analyses

Source	Outcome Measures			
	Absenteeism	Task Inattention	Fidgeting	Cooperativeness
Main Effects				
Coronary-Prone Behavior Pattern	$p<.02$	$p<.05$	*ns*	*ns*
Density	*ns*	$p<.05$ (quadratic)	*ns*	*ns*
Openness of Perimeter	*ns*	*ns*	$p<.0009$	*ns*
Window Area	*ns*	*ns*	*ns*	*ns*
Desk Arrangement	*ns*	*ns*	*ns*	*ns*
Secluded Study Space	*ns*	*ns*	$p<.02$	*ns*
Interaction Effects				
Coronary-Prone Behavior Pattern x Density	*ns*	$p<.0004$ (linear) $p<.06$ (quadratic)	$p<.08$ (quadratic)	*ns*
Coronary-Prone Behavior Pattern x Openness of Perimeter	$p<.08$	*ns*	$p<.09$	*ns*
Coronary-Prone Behavior Pattern x Window Area	*ns*	$p<.06$	$p<.02$	*ns*
Coronary-Prone Behavior Pattern x Desk Arrangement	$p<.06$	$p<.005$	$p<.008$	*ns*
Coronary-Prone Behavior Pattern x Secluded Study Space	*ns*	$p<.003$	$p<.002$	*ns*

Table 46

Arousal-Seeking Tendency and Classroom Design Factors in Relation to Outcome Measures: Summary of Analyses

Source	Outcome Measures			
	Absenteeism	Task Inattention	Fidgeting	Cooperativeness
Main Effects				
Arousal-Seeking Tendency	*ns*	*ns*	*ns*	$p < .04$
Density	*ns*	$p < .04$ (quadratic)	*ns*	*ns*
Openness of Perimeter	*ns*	*ns*	$p < .002$	*ns*
Window Area	*ns*	*ns*	*ns*	*ns*
Desk Arrangement	*ns*	*ns*	*ns*	*ns*
Secluded Study Space	*ns*	*ns*	$p < .02$	*ns*
Interaction Effects				
Arousal-Seeking Tendency x Density	*ns*	*ns*	*ns*	$p < .02$ (linear)
Arousal-Seeking Tendency x Openness of Perimeter	*ns*	*ns*	*ns*	$p < .002$
Arousal-Seeking Tendency x Window Area	*ns*	*ns*	*ns*	*ns*
Arousal-Seeking Tendency x Desk Arrangement	*ns*	*ns*	*ns*	$p < .09$
Arousal-Seeking Tendency x Secluded Study Space	*ns*	*ns*	*ns*	*ns*

square feet per student) conditions. This finding is essentially identical to data reported by Shapiro (1975) where classroom involvement was greatest at moderate density. For fidgeting, openness of perimeter and secluded study space were the major determinants. Openness was found to have a significant positive effect on restlessness, indicative perhaps of the increased arousal (Neill, 1982; Neill & Denham, 1982) or greater anxiety (Cotterell, 1984) that has been associated with students in open-space classrooms. In contrast, the availability of secluded study space may allow students to escape unwanted stimulation and may help to explain the lower levels of fidgeting found in classrooms with this amenity. Main effects of window area and desk arrangement were not found to be significant for any of the outcome measures. Most studies have failed to adequately demonstrate that either of these two variables has an impact on students (see Ahrentzen, Jue, Skorpanich, & Evans, 1982; Weinstein, 1979, for reviews).

Consistent with transactional models of stress and coping, predicted interactions between individual differences and classroom physical design factors made significant contributions to the explained variance in the outcome measures. Interactions across person and environmental variables accounted for as much as 18.5 percent of the total explained variance in absenteeism, 37.2 percent in task inattention, 38.8 percent in fidgeting, and 67.5 percent in cooperativeness, after statistical adjustment for the main effect contributions. Not all the individual interactions predicted a priori, however, were found to be significant. As shown in Tables 45 and 46, the pattern of interactions was different for the two individual difference measures. Relations between coronary-prone behavior pattern and the environmental variables were predictive of absenteeism, task inattention, and fidgeting, but not of cooperativeness. In contrast, interactions between arousal-seeking tendency and the classroom factors were only found to be significant for cooperativeness. These patterns suggest that person-environment mismatches can contribute to different kinds of behavioral and psychological costs resulting from one's attempt to cope with stressors. In the present study, relations between coronary-prone behavior pattern and physical features of the classroom setting were associated with individual-centered outcomes (e.g., fidgeting), indicating that the incessant struggle to achieve which characterizes the TABP may be primarily a self-preoccupation. On the other hand, arousal-seeking tendency/environment interactions had greater interpersonal consequences (i.e., feelings of cooperation with other students in schoolwork), consistent with the approach-avoidance aspect of this trait. The more detailed findings are discussed below.

Coronary-Prone Behavior Pattern/Environment Interactions

The results support initial predictions that coronary-prone behavior pattern and classroom design features interact to moderate the deleterious effects that can occur as a consequence of coping with stressful events. Furthermore, consistent with other reported findings (see Matthews, 1982), the data displayed several A-B differences in the way students responded to various environmental situations.

Coronary-Prone Behavior Pattern and Density. As predicted, the effects of classroom density on task inattention and fidgeting differed for Type A and Type B students. Type As showed a curvilinear relation between density and task inattention, with underload being less favorable than both moderate and high levels of density. In contrast, Type Bs were relatively unresponsive to density, showing consistently low levels of inattentiveness. Thus, with regards to allocation of attention, density had a more pronounced impact on students characterized by extremes of aggressiveness and competitive achievement striving. In terms used by Glass (1977) to explain the psychological dimensions underlying the TABP, increased attentiveness in higher density classrooms may reflect attempts by Type A students to reassert and maintain control over an uncontrollable event (e.g., density) that is perceived as potentially harmful. Higher density is often accompanied by greater competition for classroom resources (Rohe & Nuffer, 1977;

Rohe & Patterson, 1974), which makes this factor particularly relevant to Type A individuals. Other studies have found that Type As respond to salient losses of environmental control by making greater efforts to focus their attention on work and ignore annoying distractions (cf. Matthews & Brunson, 1979). In addition, consistent with findings reported by Glass (1977), the present results show that when the threat to environmental control presumably was only moderately salient (i.e., low density), Type As actually made less effort than Type Bs to reassert control.

For fidgeting, the pattern of response shown by Type A students also tended to be more favorable at moderate and high levels of density. Under low density, Type As displayed higher levels of restlessness than Type Bs. Previous findings indicate that Type A individuals, being chronically achievement-oriented, thrive on challenging and competitive situations (e.g., Roskies, Seraganian, Oseasohn, Smilga, Martin, & Hanley, 1989). The preceding discussion suggested, however, that the threat to environmental control was least salient in low density classrooms. Thus, the greater restlessness exhibited by Type A students under low density may be a reflection of the impatience elicited by an insufficiently challenging setting. For Type As, the present findings underscore the importance of an optimal level of density in facilitating an individual's capacity to cope with stressful events.

Coronary-Prone Behavior Pattern and Openness of Perimeter. The extent to which the perimeter of the classroom was characterized by open space did not have a significant effect on absenteeism. However, the predicted interaction between coronary-prone behavior pattern and openness was found to be significant. For Type A students, absenteeism decreased with increases in openness, whereas for Type B students, the tendency was in the opposite direction. Thus, A-B differences were most evident at higher levels of openness. An interpretation of this finding is suggested by the work of Matthews and Brunson (1979). Open classrooms are often noisier and more distracting than traditional classrooms (Neill & Denham, 1982; Reiss & Dyhaldo, 1975; Stebbins, 1973). Type As apparently responded to this challenge by making greater efforts to focus their full attention on task-relevant cues, while at the same time suppressing their attention to peripheral events, such as fatigue and illness, that were not immediately relevant to task performance. In contrast, Type B students presumably did not suppress their attention to symptoms. The present finding for absenteeism is also supportive of previous evidence that Type Bs become passive and withdraw from situations that they deem uncontrollable (Brunson & Matthews, 1981). The attentional explanation for observed A-B differences, however, does not explain why the predicted interaction between coronary-prone behavior pattern and openness of perimeter was nonsignificant for task inattention.

For fidgeting, the effect of openness was only found to be significant for Type Bs, with observed restlessness increasing as the amount of open perimeter space increased. As expected, however, Type Bs showed greater unease in open classrooms relative to Type As and, conversely, less nervousness than Type As in more traditional classrooms. Thus, the present findings show that openness can elicit considerable hyperresponsiveness from Type Bs and that, contrary to suggestions by others (e.g., Cohen & Edwards, 1989), the Type B behavior pattern may not act as a buffer against the potentially pathogenic effects of experiencing stressful events.

Coronary-Prone Behavior Pattern and Window Area. In an extensive survey of the literature on environments with and without windows, Collins (1975) concluded that windowless classrooms do not appear to have much impact on students. Indeed, in the present study, main effects of window area were not found to be significant for any of the outcome measures. However, as predicted, the interaction between coronary-prone behavior pattern and window area contributed significantly to the explained variance in task inattention and fidgeting. For both of these measures, distinct differences between Type As and Type Bs occurred only at higher levels of fenestration. As the amount of window area increased, Type A students showed greater inattentiveness and fidgeting, whereas for Type B students, the frequency of these behaviors decreased. The pattern of response shown here is consistent with the findings for density and openness. That is, as with density and openness, Type As exhibited behaviors characteristic of the TABP only when the apparent threat to environmental control was sufficiently salient. The results suggest that classrooms with smaller window area, or no windows at all, provide this incentive, eliciting from Type As attempts to reassert control (via increased attention to the task at hand, for example). In contrast, Type B students appeared to be more distressed by the lack of fenestration. The uncontrollability approach to windows and Type A behavior requires additional empirical examination.

Others have examined the psychological functions of windows and their work may help to shed some light on the present argument that smaller amounts of window area are particularly challenging. Collingro and Roessler (1972), for example, found a negative relationship between window size and feelings of enclosure and restraint. Similarly, window size reportedly contributes to judgments of an interior's "spaciousness" (Inui and Miyata, 1973). These findings indicate that the apparent size of a room can be influenced by the level of fenestration. We have seen that higher classroom density may trigger increased achievement-striving behaviors in Type A students; it is plausible that *perceived* density (as influenced by smaller amounts of window area) may produce the same response. On the other hand, an explanation for the responses to window area shown by Type Bs may be somewhat different. Type B individuals, in comparison to their time-urgent Type A peers, by definition are more receptive to occasional intermissions during performance of a task. Windows provide students with a view out, yielding some contact with the outside world, and may serve as visual rest centers (Collins, 1975). Type B students in the present study showed greater unease as these relief outlets diminished in size or were nonexistent, consistent with this explanation. The results suggest that the relations between amount of window area and task inattention and fidgeting are largely dependent on the influence of individual differences.

Coronary-Prone Behavior Pattern and Desk Arrangement. The predicted interaction between coronary-prone behavior pattern and type of seating arrangement (rows versus clusters) was found to be significant for absenteeism, task inattention, and fidgeting. The pattern of response was similar for each of the three outcome measures, with greater behavioral problems being reported for Type As seated in rows and for Type Bs seated in clustered arrangements. Clustered seating has been associated with higher levels of student interaction and more noise relative to row seating (Gill, 1977; Zifferblatt, 1972). Furthermore, rows may facilitate more educationally-oriented student activity (Axelrod, Hall, & Tams, 1979; Wheldall, Morris, Vaughan, & Ng, 1981). Thus, to the extent clusters make the completion of important tasks or the realization of other goals more difficult, the present findings are consistent with those discussed earlier in connection with the other classroom design factors. The reduced levels of absenteeism, off-task behavior, and restlessness displayed by Type As within classrooms with clustered workstations suggest that students characterized by chronic achievement striving reacted to encountered challenges by narrowing their attention to work and ignoring task-irrelevant peripheral events. In contrast, Type Bs responded more favorably when desks were arranged in rows and the threat to environmental control presumably was less salient.

Coronary-Prone Behavior Pattern and Secluded Study Space. Consistent with expectations, the effects of secluded study space on task inattention and fidgeting revealed significant A-B differences. The presence of discrete areas where students could go and work apart from the rest of the class was associated with high levels of inattentiveness in Type A students but low levels of inattentiveness in Type B students. For Type As, the frequency of off-task behavior declined markedly when such spaces were unavailable. The elevated levels of attentiveness shown by Type

As in these situations suggest that the absence of secluded study space was associated with salient threats to environmental control. When getaway spaces within classrooms are not available, escape from distractions may be much more difficult; furthermore, students may be required to place greater reliance on intrapersonal resources when attempting to cope with unwanted stimulation.

With regards to fidgeting, the effect of secluded study space was much more pronounced for Type B students. Type Bs demonstrated high levels of restlessness when secluded study space was not available in the classroom. Conversely, less frequent episodes of fidgeting behavior were observed when this space was present. This result is consistent with findings reported by Ahrentzen (1981) that showed isolated study areas being particularly important to students when they need to concentrate. The results of the present study suggest that the dissimilar reactions to secluded study space displayed by Type As and Type Bs may be attributable to respective differences in their attentional styles.

Arousal-Seeking Tendency/Environment Interactions

The results provide some support for initial predictions that arousal-seeking tendency and classroom design factors interact to moderate the efficacy of adapting to stressful events. Significant effects, however, were limited to students' orientation toward cooperativeness. This finding suggests that arousal-seeking tendency had no implications for absenteeism, task inattention, and fidgeting behavior, regardless of environmental differences in the classrooms. For cooperativeness, interactions between arousal-seeking tendency and classroom factors were found to be significant for density, openness of perimeter, and type of desk arrangement. Thus, the positive relation between arousal-seeking tendency and cooperation was moderated by environmental variables that previously have been shown to play a role in regulating social interaction (e.g., Aiello, Nicosia, & Thompson, 1979; Sommer, 1969; Weinstein, 1979).

Arousal-Seeking Tendency and Density. Although the predicted curvilinear relationship between density and cooperativeness was not found to be significant, the interaction between arousal-seeking tendency and density contributed significantly to the explained variance in the outcome measure. Contrary to expectations, for low-arousal-seeking students, the tendency was for cooperativeness to increase with increases in density. The direction of the present finding is different from that typically reported in studies of density and behavior. For example, data indicate that individuals with preferences for large interpersonal distances experience more physiological stress in high-density situations than in medium-density situations (Aiello, DeRisi, Epstein, & Karlin, 1977). However, as cautioned in the previous chapter, the present finding for cooperativeness may be rendered invalid because of statistical abnormalities.

Arousal-Seeking Tendency and Openness of Perimeter. In classrooms characterized by a high degree of containment, there were no evident differences between high- and low-arousal-seekers in their reported orientation toward cooperativeness. As the amount of open perimeter space increased, however, the level of cooperativeness increased for high-arousal-seeking students, but it decreased for their low-arousal-seeking peers. Considering the arousal-eliciting qualities of open-space classrooms (Neill, 1982; Neill & Denham, 1982), the present finding is consistent with the view that behavioral decrements occur when ambient stimulation rises above optimal levels.

Arousal-Seeking Tendency and Desk Arrangement. The form of the interaction between arousal-seeking tendency and seating arrangement was similar to that discussed above for openness. Classrooms in which workstations were arranged in rows showed negligible differences in cooperative attitude among high- and low-arousal-seekers. In contrast, when seating was clustered, students scoring high on the arousal-seeking scale reported increased cooperativeness; low-arousal-seeking students, on the other hand, reported decreased levels of cooperativeness. It has already been suggested that clustered arrangements are more arousal-producing than rows (e.g., Gill, 1977; Zifferblatt, 1972). Thus, the present study suggests that relations between seating arrangement and reported cooperativeness were largely influenced by the approach-avoidance tendencies of students in the classroom setting.

Conceptual Issues

For students in the study, absenteeism, task inattention, fidgeting behaviors, and level of cooperativeness represented some of the behavioral and psychological costs of adapting to stressors. The present findings demonstrate that coping responses are not determined solely by intraindividual processes associated with individual differences and perceptions of the stimulus situation, but also by external factors, particularly the nature of the physical environment in which the stressful episode occurs. Substantial proportions of the explained variance in the outcome measures (ranging from 18.5 percent to 67.5 percent) were due to interactions across different types of person and environmental variables. Admittedly, methodological shortcomings may prevent the establishment of causality and cloud interpretation of the findings. Yet the importance of this study relative to prior classroom research lies not in the microscopic findings but rather in the empirical support given to the concept of person-environment interactions.

The predominant custom in classroom research has been to ask "What is *the best way* to organize the environment in order to foster learning?" That tradition implicitly assumes that settings can be ranked and that an efficient learning environment can be engineered and standardized, best for everyone. A survey of the research literature reveals little support for this proposition; the results generally have been inconclusive at best and at times have been contradictory. By abandoning the traditional approach, the present study has been able to demonstrate that different persons are sensitive to different aspects of the classroom environment. Furthermore, an interactionist formulation may yield significant effects that otherwise may be obscured by only examining the main effects of environmental conditions on learning in children. For example, it was mentioned previously that most studies have failed to adequately show that either windows or seating arrangement has an impact on students. The current findings suggest that these two variables *do* have an impact, but that the effects are moderated by individual differences (i.e., coronary-prone behavior pattern and arousal-seeking tendency). Thus, the interaction of person and environmental variables may provide more explanatory power than is afforded by a separate examination of either person or setting variables alone.

The findings of the present study are theoretically relevant in the context of transactional models of stress and coping. The findings provide support for the theoretical arguments of Lazarus and Folkman (1984) which emphasize the interactive nature of stressful transactions. However, the mediating role of cognitive appraisal, a pivotal construct in transactional theories, was not directly examined. Instead, person and environmental variables were treated as direct and identifiable sources of variance in coping responses. While recent data have suggested that person and environmental factors that influence appraisal are of equal importance to subjective appraisal in predicting coping (Newton & Keenan, 1985), further research is required to clarify the specific cognitive processes used by children to evaluate the significance of what is happening for their well-being. The concept of appraisal may provide an explanation for the interaction effects found in the present study. For example, open space classrooms often provide students with many opportunities for choice. Type As may have had a tendency to appraise openness as a challenge that holds the possibility for mastery or gain (e.g., being able to choose from among a variety of activities allowed them a chance to achieve that much more). These students responded with reduced absenteeism, as they apparently made greater efforts to focus their full attention on task-relevant cues at the expense of attending to fatigue or illness. On the other hand, Type Bs may have viewed openness as harmful or threatening. They reacted by withdrawing from the stressful encounter, as demonstrated by their increased levels of absenteeism.

In addition to children's appraisal processes, future research also needs to examine the properties of environmental factors that make them stressful. Previous sections of this paper have suggested that classroom variables may be regarded in terms of their uncontrollability. For example, clustered seating arrangements may decrease a student's ability to resist unwanted social interactions. High levels of density may increase competition for resources. Evans, Kliewer, and Martin (1988) have proposed other underlying dimensions of the physical setting, including pathogenic conditions, stimulation levels, functional complexity, structure and predictability, and exploration opportunities.

Individual variations in the extent to which environmental characteristics are appraised as stressful would be expected by transactional theories. Thus, in the present study it is of theoretical interest that scores on the outcome measures were determined by different combinations of person and environmental variables. Relations between coronary-prone behavior pattern and the classroom factors were predictive of absenteeism, task inattention, and fidgeting, but not of cooperativeness. That the TABP is associated with individual-centered outcomes is consistent with research which characterizes Type A persons as being preoccupied more with achievement and ambition than with socializing (Ditto, 1982; Jenkins, Zyzanski, Ryan, Flessas, & Tannenbaum, 1977). Other studies have suggested that Type As are particularly concerned about maintenance and enhancement of their self-esteem (cf. Matthews, 1982) and that they tend to have a fear-of-failure orientation (Gastorf, Suls, & Sanders, 1980; Gastorf & Teevan, 1980), providing further support for the notion that the TABP may be primarily a self-preoccupation. In contrast to the above, interactions between arousal-seeking tendency and the environmental variables were only found to be significant for cooperativeness. This finding that sensation-seeking is more strongly related to an interpersonal outcome is consistent with the approach-avoidance dimension of this trait (Mehrabian & Russell, 1974). The patterns in the data suggest that different interactions between person and environmental variables, representing different appraisals, may lead to different types of coping responses.

Additional research is required in order to identify other combinations of person and environmental variables which may influence the ways individuals attempt to manage stressful transactions. To date, very few studies have examined the interaction between individual differences and features of the classroom setting. Judd (1974) found that students characterized by an internal locus of control had more positive attitudes toward school when they were in open space classrooms, whereas externals had more positive attitudes when in traditional classrooms. Schuster, Murrell, and Cook (1980) observed preschool children across six different behavior settings in their nursery school and found that person, setting, and person-setting interactions all significantly contributed to social behavior. Individual analyses showed that younger children, girls, those with lower IQs, and those who had attended the school for at least one year had more consistent behavior across settings. Intrapersonal factors such as coping styles, coping flexibility, self-esteem, and private self-consciousness have been suggested as playing a possible role in stress buffering (Cohen & Edwards, 1989); further research could explore the moderating contributions of environmental factors in providing protection from stress-induced symptomatology.

The primary interest of the present study involved interactions between individual differences and physical design factors. Relevant psychosocial dimensions of the classroom setting (e.g., rule clarity, innovation) were measured and treated as covariates in multiple regression analyses. Yet, hypotheses regarding possible interactions between these variables and both person and environmental factors also could be developed and tested. For example, the affiliation dimension (the extent to which students help each other, get to know each other, and enjoy working together) would be predicted to interact with arousal-seeking tendency and seating arrangement. In addition, future research might investigate interactions involving the needs and desires of the teacher. In an earlier study, Ahrentzen (1980) found that class size preferences of the teacher interacted with actual enrollment to influence perceived distraction. Finally, the work of Cohen et al. (1986) suggests that home conditions may bear upon a child's reactions to environmental stress at school. Examination of cross-setting interactions would further our understanding of the complex interrelationships that exist between children and their environments.

The present study also may be viewed in the context of models of person-environment fit. These theories postulate that stress results from an unsuitable match between the needs of the person and the opportunities of the environment (cf. Caplan, 1983; French, Rodgers, & Cobb, 1974). The findings indicate that certain person-environment relations may contribute to an individual's reduced capacity to cope with environmental demands. For instance, the greater absenteeism reported for Type A students in closed-perimeter classrooms suggests that Type As are better suited to open classrooms. However, the reason absenteeism was lower in open classrooms may have been because Type As, in responding to distractions, suppressed their attention to task-irrelevant cues such as fatigue and illness. To the degree that the attentional style of Type A persons can account for their failure to report symptoms, this style may contribute to their risk for heart disease (Matthews & Brunson, 1979). Matching Type A children with high-challenge classrooms, then, accommodates the TABP and may serve only to place these youngsters in jeopardy for coronary disease in their later years. Thus, "Type A-environment fit" may be an oxymoron and it may be inappropriate to apply this concept to the TABP. Empirical research might better address the appraisal processes that underlie the specific coping responses used by Type A children to deal with stressful aspects of their environment. This argument also underscores the need to develop intervention programs to modify the behavioral and physiological stress responses of individuals classified as Type A. Although the stability of the TABP has not been established (Steinberg, 1986), additional research is needed to examine the long-term implications of Type A behavior in children.

Methodological Issues

Designing a study is inevitably an exercise in compromise (Cronbach & Snow, 1977). The investigator often must balance methodological soundness against the realities of the research setting and limited resources. This is particularly true for naturalistic studies, most notably when attempts are made to employ passive-observational approaches for the purpose of causal inference. Issues of inference and interpretation were discussed in previous sections of this paper and will not be repeated here. Instead, the following discussion will consider other methodological matters suggested by the present study.

The required use of nonprobability sampling, in which there was no assurance that every element of the population had *some* chance of being included in the sample, limits the generalizability of the findings. The dependence on volunteers already situated in various classroom settings meant that biases may have been introduced into the sample. Reasons for nonparticipation included the perceived time commitment, competing obligations, and uncertainties about the appropriateness of using students as research subjects. Informal observations, however, provided no reason to suspect that nonparticipants differed significantly from those participating in the study. The difficulties encountered in obtaining volunteers also served to depress the sample size as well as the number of classrooms involved in the study. This had implications for the probability of Type II error and the between-groups variance of the classroom design factors.

The reliability and validity of several of the measures require further refinement. For example, the internal consistency of the arousal-seeking tendency measure, as determined by coefficient alpha, was only a moderate .65. Many of the outcome measures originally proposed for this study (e.g., task persistence, participation) failed to demonstrate sufficient variance to warrant inclusion in the analyses. Alternative or parallel forms of these instruments should be tested.

Despite the aforementioned limitations, the research approach taken here extends previous classroom studies in several directions. First, the probability of spurious correlations between individual difference and coping response data was significantly reduced through the use of multiple methods (e.g., student interviews, behavioral observations, teacher ratings), rather than relying on subjective, self-report measures for both independent and dependent variables. Second, the outcome measures in the present study departed from the traditional application of achievement variables as the sole criterion of success in school. The appropriateness of this custom has been questioned by other researchers (e.g., Moos, 1979; Sommer, 1973; Weinstein, 1979). Third, where possible the physical characteristics of the classroom were represented by interval-level measurements, rather than the nominal-level dichotomies often used to describe educational settings. The conventional labels (e.g., open space versus traditional, windowed versus windowless) compound within-group error and make comparison of research findings extremely difficult. Finally, the present work accounted for possible variance in the outcome measures due to differences in the psychosocial qualities of the various classrooms, a dimension heretofore ignored in research on the physical environment of the school.

The present study treated person and environmental variables as direct predictors of coping behavior and made no attempt to study the reciprocal interactions between coping, appraisal, and response that take place during the course of a stressful encounter (Lazarus & Folkman, 1984). Future research needs to account for these complex processes. For example, longitudinal studies may capture the fluctuating nature of coping and cognitive appraisals. However, current research methods are not yet adequate to accommodate fully the theoretical and empirical complexity of process-oriented, transactional models of stress (Parkes, 1986). Less complex approaches to stress research will have to suffice until further progress in methodology has been made.

Concluding Remarks

The present study provides support for the concept that responses to environmental aspects of the learning situation are mediated by individual differences. Thus, there is no single best classroom setting. The best classrooms are those that are responsive to all learners. In practice, however, the realization of this objective may be insurmountable, particularly with respect to physical design features of the classroom. Matching children to particular types of classroom factors, besides being administratively cumbersome, may have the unintended effect of stratifying different groups of children since the classroom setting is rarely independent of the educational program within it. As an alternative, it is suggested that children be given opportunities to assume personal responsibility for their classrooms and that they be allowed to make decisions regarding the utilization of their space. For example, students can decide individually whether to be seated in rows or in clusters. The underlying assumption here is that targeting interventions at the properties of environmental factors that make them stressful (e.g., uncontrollability) is much simpler than physically altering those factors (e.g., architecturally renovating the classroom). The challenge lies in identifying what the interventions should be and to whom they should be directed.

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Appendix A

Target Student Questionnaire

PLEASE NOTE

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Appendix A 179-192
Appendix B 194-197

Appendix B

Classroom Environment Scale

Appendix C

Behavioral Observation Checklist

School:
Grade:
Classroom Number:

Observer:
Date:
Time Begin:

BEHAVIOR CATEGORY	STUDENT'S NAME AND MARKING					
Physical Contact/Personal Space Invasion	+ - R	+ - R	+ - R	+ - R	+ - R	+ - R
Verbalization: Questioning Behavior *(S > T)*	P C	P C	P C	P C	P C	P C
Participation: *Teacher-Initiated (T > Ss > T)*	+ - R	+ - R	+ - R	+ - R	+ - R	+ - R
Participation: *Unsolicited (S > T)*	+ - R	+ - R	+ - R	+ - R	+ - R	+ - R
Social Initiation *(S > S)*	+ - R	+ - R	+ - R	+ - R	+ - R	+ - R
Vocalization	+ - R	+ - R	+ - R	+ - R	+ - R	+ - R
Fidget/Movement						
Translocation						
On Task/Off Task	On Off	On Off	On Off	On Off	On Off	On Off
Disruption						
Classroom Situation Code: a. Teacher working with entire class. b. Teacher working with a group of kids, including target. c. Teacher working with a group, not including target. d. Teacher working individually with target. e. Teacher circulating, etc. (kids working independently).						

Appendix D

Teacher Questionnaire

Confidential

TEACHER QUESTIONNAIRE

How teachers arrange their classrooms and methods of teaching reflect factors such as the conditions under which the school operates and the characteristics of the students. At present, little is known about the way in which teachers adapt their methods to circumstances, and hence little advice can be passed on to students training to be teachers.

For our work on classroom design to be of any value, we must obtain responses from a wide cross-section of teachers. I hope you will feel that this project is sufficiently worthwhile to merit your support. It generally takes about half an hour to complete the questionnaire and, of course, replies are *confidential*. It is important that you try to record as objectively as you can what actually happens in your classroom.

Most of the items in this questionnaire ask you to choose one answer from a number of alternatives by *circling the appropriate CODE NUMBER*. We realize that this procedure may occasionally involve oversimplification. Other items require a more specific response and you are asked to enter the appropriate figure in the box provided. It is important to answer all the questions.

PART 1 THE TEACHER AND CLASS

---

1. a. School . . . .
   b. Grade . . . .
   c. Classroom Number . . . .

2. Sex:

   Male 0
   Female 1

3. Teaching experience (in years):

   Total . . . . [ ]
   In primary schools . . . . [ ]
   In secondary schools . . . . [ ]

4. What is the ability level of your pupils?

   Mostly bright 0
   Bright/average 1
   Average 2
   Average/dull 3
   Mostly dull 4
   Full ability range 5

PART 2 TEACHING METHODS ADOPTED

SEATING ARRANGEMENTS

5. Do your pupils decide for themselves where they sit in the classroom?
   No 0
   Yes 1

6. Are pupils allocated to places or groups on the basis of their ability?
   No 0
   Yes 1

7. Are pupils allowed to decide how furnishings are to be arranged?
   No 0
   Yes 1

8. How similar is the physical arrangement of your present classroom compared to any other classrooms you may have taught in?
   Very different 0
   Somewhat similar 1
   Very similar 2
   Virtually identical 3
   Not applicable 4

9. What would you say are the best and worst physical design features of your current classroom?

   a. *Best:* 1.

   2.

   b. *Worst:* 1.

   2.

CLASSROOM ORGANIZATION

10. Do you usually allow your pupils to move around the classroom
    generally whenever they wish? 0
    only during certain kinds of
    curricular activity? 1

11. Do you usually allow your pupils to talk to one another
    usually whenever they wish? 0
    only during certain kinds of
    curricular activity? 1

12. Do you expect your pupils to ask you permission before leaving the room?
    No 0
    Yes 1

13. Do you expect your pupils to be quiet most of the time?

No	0
Yes	1

ORGANIZING THE CURRICULUM

14. Do you use a timetable for organizing the week's work?

No	0
Yes	1

15. Do you regularly give your pupils homework?

No	0
Yes	1

16. In organizing the work of your class, roughly what emphasis do you give to each of these five different approaches? Indicate approximately what percentage of time is spent on each approach. Your total should come to 100%, although this is not intended to imply that all the work necessarily fits into these five categories.

a. Teacher talking to the class as a whole	
b. Pupils working together cooperatively in groups, on work given by the teacher	
c. Pupils working together cooperatively in groups, on work of their own choice	
d. Pupils working individually, at their own pace, on work given by the teacher	
e. Pupils working individually, at their own pace, on work of their own choice	
TOTAL	100%

17. On which aspect of number work do you place *more* emphasis?

a. Developing computational skills through graded exercises?	0
b. Exploring concepts with materials or apparatus?	1

GRADING

18. Do you put an actual mark or grade on pupils' work?

No	0
Yes	1

19. Are stars, or their equivalent, given to students who produce the best work?

No	0
Yes	1

DISCIPLINE

20. For persistent disruptive behavior, where verbal reproof fails to gain the pupil's cooperation, do you use any of the following disciplinary measures?

a. *Extra work*	No	0
	Yes	1
b. *Spank*	No	0
	Yes	1
c. *Withdrawal of privileges*	No	0
	Yes	1
d. *Send to principal or other authority*	No	0
	Yes	1
e. *Send out of room*	No	0
	Yes	1

PART 3 OPINIONS ABOUT EDUCATION

In this section we ask you to give your opinions about a number of educational topics. We are anxious to record the frank opinions of professional teachers and there is no suggestion that there are right or wrong answers. It is important to answer every question.

TEACHING AIMS

The following are probably all worthwhile teaching aims, but their relative importance may be influenced by the situation in which the teacher works. Please rate each aim on the five-point scale to indicate its importance in relation to your class by circling the appropriate code number.

	NOT IMPORTANT	FAIRLY IMPORTANT	IMPORTANT	VERY IMPORTANT	ESSENTIAL
21. Preparation for academic work in secondary school	1	2	3	4	5
22. An understanding of the world in which pupils live	1	2	3	4	5
23. The acquisition of basic skills in reading and number work	1	2	3	4	5
24. The development of pupils' creative abilities	1	2	3	4	5
25. The encouragement of self-expression	1	2	3	4	5

	NOT IMPORTANT	FAIRLY IMPORTANT	IMPORTANT	VERY IMPORTANT	ESSENTIAL
26. Helping pupils to cooperate with each other	1	2	3	4	5
27. The acceptance of normal standards of behavior	1	2	3	4	5
28. The enjoyment of school	1	2	3	4	5
29. The promotion of a high level of academic attainment	1	2	3	4	5

OPINIONS ABOUT EDUCATIONAL ISSUES

Please indicate the strength of your agreement or disagreement with the following statements by circling the appropriate code.

	STRONGLY DISAGREE	DISAGREE	NO OPINION	AGREE	STRONGLY AGREE
30. Most pupils in upper elementary school have sufficient maturity to choose a topic to study and carry it through	1	2	3	4	5
31. Most pupils in upper elementary school feel more secure if told what to do and how to do it	1	2	3	4	5
32. "Creativity" is an educational fad which will soon die out	1	2	3	4	5
33. Firm discipline by the teacher leads to good self-discipline on the part of the pupils	1	2	3	4	5
34. The teacher should be well-liked by the class	1	2	3	4	5
35. Children working in groups waste a lot of time arguing and "messing about"	1	2	3	4	5
36. Pupils work better when motivated by marks or stars	1	2	3	4	5
37. Too little emphasis is placed on keeping order in the classroom nowadays	1	2	3	4	5
38. Teachers need to know the home background and personal circumstances of their pupils	1	2	3	4	5
39. In general, formal teaching methods are to be preferred over informal teaching methods	1	2	3	4	5
40. I have been able to modify, for the most part, the physical aspects of my present classroom to best suit my teaching method	1	2	3	4	5

PART 4 **THE STUDENTS**

In this section we ask you to rate randomly selected students from your class. Their names are given below. Parental permission has been obtained. Please rate each child as objectively as possible by writing the appropriate code numbers in the boxes below each student's name. It is important to answer each question.

	Code Number
Extremely uncharacteristic	1
Somewhat uncharacteristic	2
Neutral	3
Somewhat characteristic	4
Extremely characteristic	5

41. When playing games, he/she is competitive										
42. Works quickly and energetically, rather than slowly and deliberately										
43. When having to wait for others, he/she becomes impatient										
44. Does things in a hurry										
45. It takes a lot to get this child angry at his/her peers										
46. Interrupts others										
47. A leader in various activities										
48. Gets irritated easily										
49. Seems to perform better than usual when competing against others										
50. Likes to argue or debate										
51. Is patient when working with kids slower than he/she is										
52. When working or playing, tries harder to do better than other children										
53. Can sit still long										

	Code Number
Extremely uncharacteristic	1
Somewhat uncharacteristic	2
Neutral	3
Somewhat characteristic	4
Extremely characteristic	5

54. It is important to this child to win, rather than to have fun in games or schoolwork										
55. Other children look to this child for leadership										
56. Is competitive										
57. Tends to get into fights										
58. Is creative										
59. Often absent										

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

PLEASE PLACE IN RETURN ENVELOPE AND MAIL

If you would like to make additional comments, or to elaborate on answers to our questions, or to suggest aspects of classrooms we may have overlooked, please make use of the space below. We would be grateful for your comments.