CLASSROOM CLIMATE AND STUDENTS' ATTITUDES TOWARDS MATH

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The paper I am about to present is a result of investigations of the relationship between the climate of the classroom and students' attitudes towards math.

I became interested in this topic as I read Sarason's book on the Culture of the School and the Origins of Change, and Boocock's article on Social Organization of the Classroom. Both pieces bemoaned the inconclusive findings of studies attempting to relate classroom climate to any other measure.

Reviews of the literature on classroom climate cite particular problems which may contribute to the lack of conclusiveness. First among these problems is an inadequate conceptualization of classroom climate. Consequently, there is little consistency in measurement or methodology.

One source of the rather hazy definitions of classroom climate may be the focus on trying to define the climate itself (clearly intangible) rather than defining the theoretical reasons for looking at classroom effects, and from that point predicting specific effects upon students' behaviors.

From a sociopsychological perspective, one of the fundamental assumptions of this research is that the classroom, composed of one usually dominant and powerful teacher and many less powerful students, is an organization. It is a system complete with a set of values and demands which may have powerful effects upon the formation of a child's school-related attitudes and values.

This reasoning is very similar to that of Kohn and Schooler, two sociologists investigating the impact of the structure of a man's job upon his psychological functioning and attitude formation. They found a significant relationship between the complexity of the job and a man's ability to adjust to novel situations. This relationship held up over a ten year time-span. The difference in the complexity of the job signifies differences in the kinds of tasks performed and the kind of feedback received concerning the quality of performance, and illustrates the socializing potency of one's environment.

But let me further illustrate the application of this reasoning to the situation in the classroom. Differences in teaching style result in differences in the tasks students perform in class, as well as differences in the amount and type of encouragement that he or she receives. For instance, an autocratic teacher may lecture in front of the class all period drilling the students, making sure they have their homework, and demanding attentiveness. Another type of teacher might adopt a style in which students worked on assignments in class at their own pace. If they had a problem, then the student might signal a need for help. The demands upon the students, in each case, are very different. Furthermore, the amount of qualitative feedback students could receive in each case may be also very different. In the autocratic classroom, there may be little time for encouragement, praise, or any other type of evaluative comments to be made to individual students. This opportunity may exist to a greater extent in a more self-paced class.

If the phenomenon Kohn and Schooler documented can be applied to the school setting, you might suppose that the students' attitudes, values, and expectancies are influenced by their experiences in certain types of classes.

Because our perspective is basically sociopsychological, we also believe that the individual brings a unique set of needs, values, and attitudes to any situation. Consequently, we assume that different individuals react to the same environmental influences differently.

Due to the nature of the goals of our research project, the indicators of classroom climate are based on classroom observations: a low inference measure which is consistent with my focus on a structural perspective of classroom interaction patterns and teacher style.

Methods

Instrument

The observation system implemented in this study is a modified version of two other systems, the Brophy and Good teacher-child dyadic interaction system, and the Dweck et al. observational system to code evaluative feedback. The resulting system was modified according to results of pilot observations in a variety of classrooms. In making alterations, we considered the relevance of procedure to our research goals and administrative ease.

Our observation system focused on dyadic interactions, or occasions in which the teacher interacted with a single student. We did not code any interactions in which the teacher addressed comments to a group of students or to the class. Recordings of interactions included: 1) who initiated the interaction, 2) the type of interaction initiated, 3) the type of response the student gave the teacher, and 4) the type of feedback the student received from the teacher. In addition, we noted whether the interaction was public and monitored by the class, or was a private interaction between the student and the teacher. We also made an effort to pick up two types of statements made by the teacher regarding how well the students should expect to do (i.e. expectancy statements), and an assessment of why the student succeeded or failed at a task (attributional statements).

Analysis

Now let me turn to the path analyses that were performed in order to obtain an idea about the contribution of classroom climate to students' attitudes. First I shall describe the variables that were used, then I shall present the results.

Control Variables

Three variables were used as control variables in the first analysis: sex, grade, and math aptitude (as assessed by a combination of math grades and standardized test scores).

Sex was controlled because of its ability to differentiate attitudes towards math.

It was necessary to control for grade for two reasons. First, teachers use different styles to teach fifth-graders and ninth-graders because their needs differ. Secondly, math attitudes become increasingly negative with age.

The students' math aptitude was controlled because of the possibility that teachers respond differently to bright students, as well as the fact that positive attitudes towards math increase with aptitude.

Predictor Variables

Three variables reflecting classroom climate were used as predictor variables. First, we assessed the mean number of public interactions relative to the mean number of private interactions. A large score reflects a larger proportion of public interaction (teacher-initiated questions), suggesting the use of a lecture style of teaching, with questions directed to the students in order to make certain points and to make sure the students understand the material. A smaller score indicates few public interactions relative to a large number of private dyadic interactions. This reflects a more private style of teaching, where the teacher allows the students to work at their own pace. Students' questions are answered by the teacher as they arise, in a setting which is not monitored by the class.

Second we assessed the mean amount of work-directed praise in a classroom. This type of praise was included in the set of predictor variables as a general measure of encouragement given by the teacher.

The third indicator of classroom climate is the mean amount of conduct-directed criticism in a class. Large amounts of conduct criticism could reflect a certain amount of chaos in a classroom, a lack of control by the teacher, and students' lack of interest.

<u>Outcome Variables</u>.

Five measures of the students' attitudes toward math were used in these analyses. The following measures aggregate several scales derived from the student questionnaire and reflect different aspects of the interaction between the student and the task:

1) <u>Ability concept</u>. The student's concept of his or her ability to do math.
2) <u>Concept of task difficulty</u>. The student's concept of the difficulty of math.
3) <u>Concept of the value of math</u>. The student's interest, liking, and perceptions of the usefulness of math.
4) <u>Expectancies for success in math</u>. Current and future

expectancies for success in math, and one component of the expectancy X value model of motivation.

5) Future ability of math. The perceived instrumentality of math for achieving desired future goals, i.e. the value of math (the second component of the expectancy X value model of motivation).

Results

The first path analysis, shown in Figure 1, was performed in an exploratory fashion to see if there were any relationships between classroom behaviors and students' attitudes.

Controlling for sex, aptitude, and grade, we found a negative relationship between the public teaching style and concepts of ability and task difficulty. Public teaching styles engendered feelings of relatively low ability and high task difficulty. Additionally, work praise and conduct criticism were unrelated to math attitudes.

High expectancies for future success in math were more likely to be held by boys, and were predicted by high concepts of ability and a positive value of math. High future utility was predicted by a positive value of math.

The first path analysis confirmed suspicions that the classroom environment was affecting students' attitudes towards math, but it did not test and could not test whether different types of students reacted differently to similar classroom situations.

First, the sample was stratified by sex to see if boys and girls react differently to teaching style or encouragement. No differences were observed between the sexes.

Second, the sample was stratified by teachers' expectations for the child's future success in mathematics. These groups of students are labelled "bright" and "less bright". Their reactions to the classroom environment are represented in figures 2 and 3.

Among the less bright students, low concepts of their ability to do math resulted from a combination of low math aptitude and a classroom dominated by public interactions; and the situation seems to worsen as the students got older. Among bright students, concepts of ability were significantly predicted by math aptitude alone.

Among less bright students, a belief in the difficulty of math was predicted by the child being in a class dominated by public interactions. Further, these students perceived math as more difficult in higher grades. Bright students in dominantly public classes also believed math to be more difficult. However, there is no direct effect of grade level upon perception of task difficulty. Bright students do not seem to think math any more difficult in ninth than in fifth grade. Their concept of task difficulty did seem to be influenced by the amount of work praise they received--the more praise they received, the easier they perceived math to be. Additionally, and not surprisingly, the higher their math aptitude, the easier they perceived math to be.

The value of math for less bright students was diminished in classes with dominated by public interactions--and did not seem to vary as a function of grade level or math aptitude. Contrarily, bright students' concepts of the value of math were heightened in classrooms with dominantly public interactions. Children with higher math aptitude showed increases in positive assessments of math while children at higher grade levels showed a deficit.

Expectancies for success were predicted by a combination of ability and value concepts for both groups; and perceptions of future utility were predicted by current value concepts in both groups--but among brighter students, females perceived math as having less future utility, perhaps reflecting a perception of our culture's occupational segregation.

Conclusions

These results raise several questions concerning the meaning of the observed relationships. One may legitimately ask what it is about public as opposed to private classrooms that elicits a lack of faith in one's ability to do well, and a perception of math as a difficult subject. In fact, there are several characteristics of a public style classroom which might discourage a student with lower ability and lower self-confidence. Because the teacher is likely to use drills as a method of teaching, the student is more likely to experience failure by getting an answer wrong, and there may be less opportunity for the teacher to give those individuals encouragement as there is less time for dyadic interactions. In addition, students have less control over the process of their own learning, and may be forced to proceed even if they are not prepared to do so.

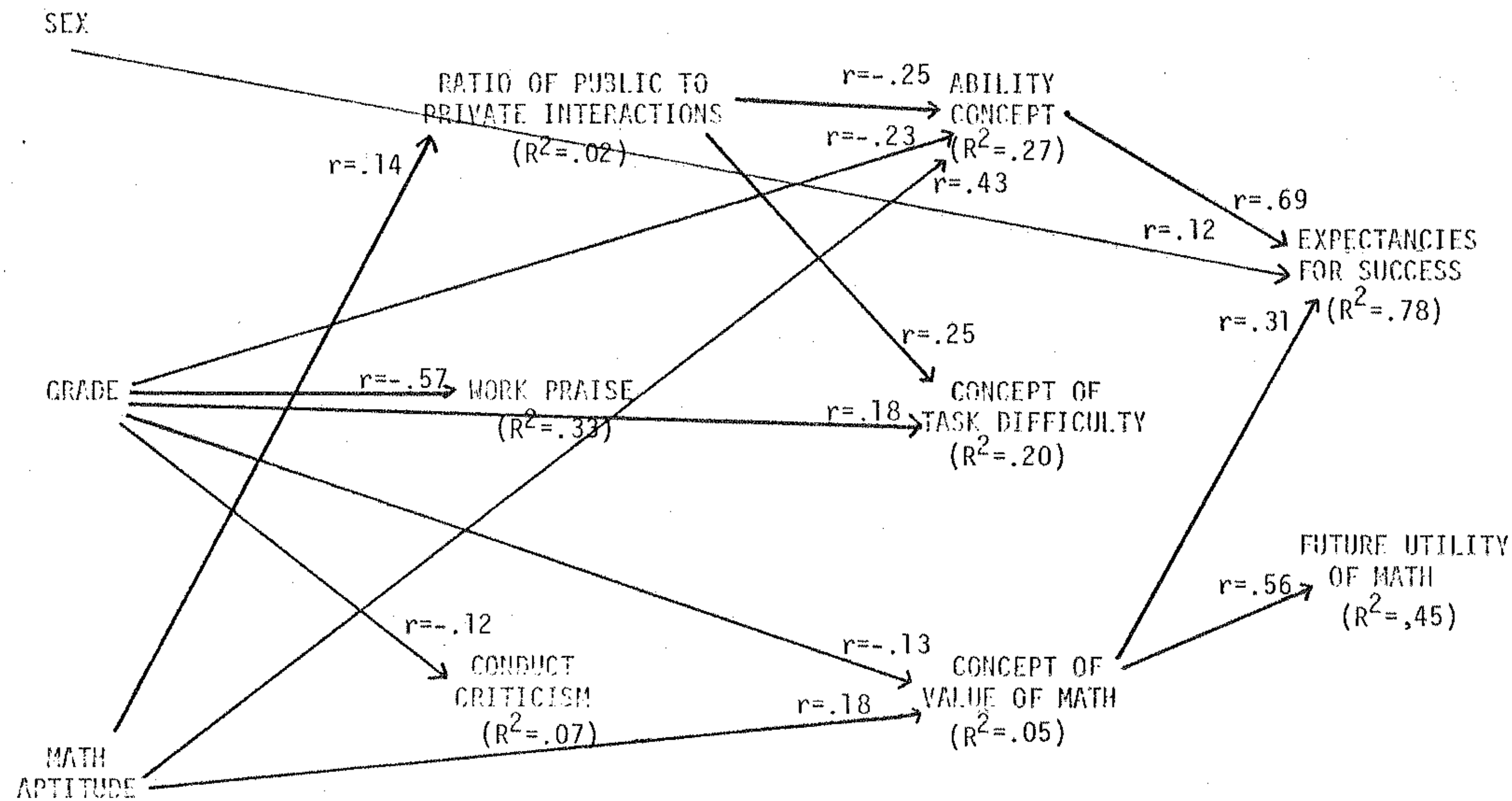
One might also ask why the amount of work-praise received in class affects brighter students' attitudes about the difficulty of math, yet not those of the less bright students.

It is possible that brighter students are more likely to attribute success (as signalled by work-praise) to task ease rather than to ability, and failure to task difficulty, thus building a defense against relatively high probabilities of receiving failure feedback at the expense of making "healthier" attributions of success to one's own ability.

The fact that less bright students may not associate similar types of successes to task ease may suggest that this attributional pattern for success and failure is the most adaptive in a subject where so much success and failure feedback is received.

Figure 1

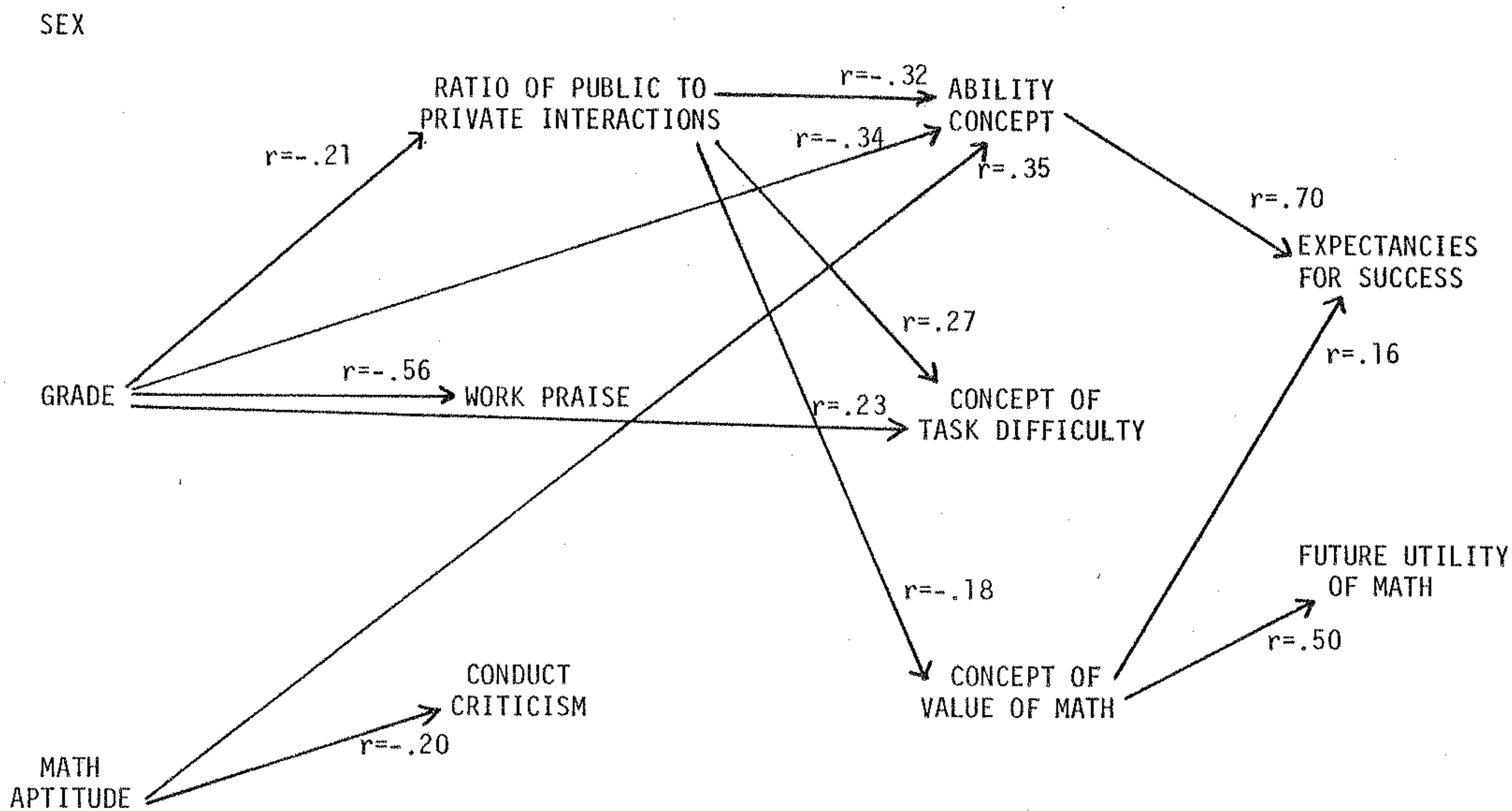
Path Analysis of Relationship Between
Classroom Behaviors and Students' Attitudes



All paths significant at $p < .05$

Figure 2

Path Analysis of Relationship Between Classroom Behaviors and Students' Attitudes Among Less Bright Students[1]

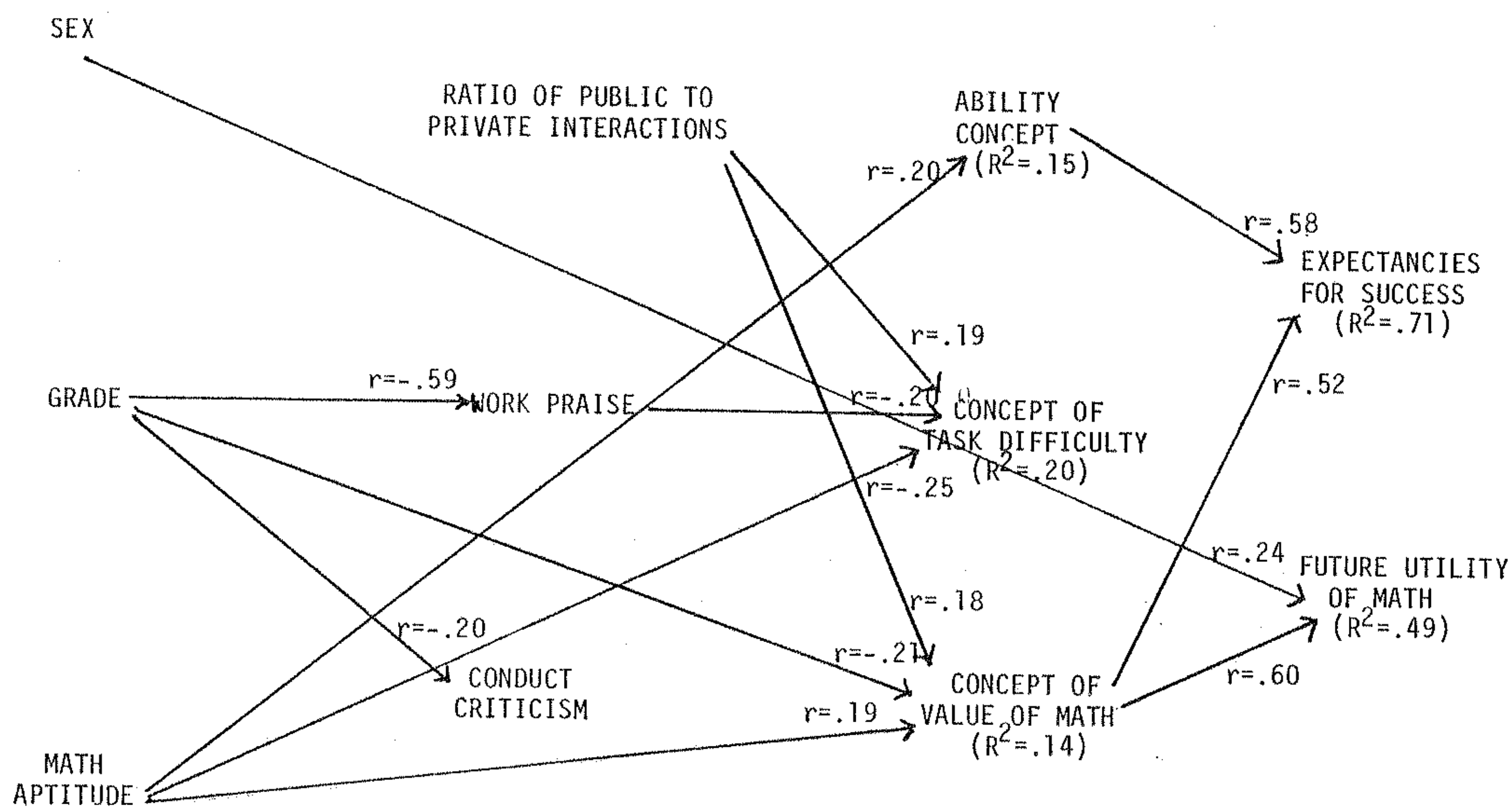


1 According to teachers' evaluations.

All paths significant at $p < .05$

Figure 3

Path Analysis of Relationship Between Classroom Behaviors and Students' Attitudes Among Bright Students[1]



1 According to teachers' evaluations.

All paths significant at $p<.05$