MANAGEMENT AND ORGANIZATION IN SCIENCE CLASSROOMS*

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Abstract

Twenty-six junior high and middle school science classes taught by 13 teachers were observed frequently during the first 2 months of school and during 2 months in the middle of the year to identify classroom management and instructional organization variables related to high levels of student task engagement and low levels of off task and disruptive behavior. Subsamples of more and less effective managers were identified, and narrative data from their classes were analyzed to describe and illustrate effective strategies for managing science classroom activities.

Most junior high school science teachers receive little or no preservice training to prepare them to teach students in the junior high or middle school age group (Hurd, Robinson, McConnell, & Ross, 1981). Keeping large groups of students engaged in instruction that may require taking notes, following complex procedures, handling equipment, and/or working in groups challenges the classroom management skills of many teachers at that grade level, especially those who do not have much teaching experience. Several large-scale surveys have indicated that science teachers are concerned about classroom management and student discipline (Hurd et al., 1981; Stake & Easely, 1978). Many say they have difficulty managing laboratory activities and using "hands on" materials with students (Weiss, 1978). Previous research at the secondary school level has established relationships between teachers' management behaviors, student task engagement and cooperation with the teacher, and learning gains (Evertson & Emmer, 1982; McGarity & Butts, 1982; Newton & Capie, 1982; Stallings, Needels, & Stayrook, 1979).

This study extends previous classroom management research by examining management and organization in 26 classes taught by 13 science teachers in middle and junior high schools. Measures of student on task, off task, and disruptive behavior are used as criteria for management effectiveness. Based on about 25 observations of each teacher, classroom management and organization behaviors related to the student behavior criteria are identified, and management and organization patterns in classes taught by more and less effective managers in the sample are compared.

The science classes included in this study were part of the Junior High School Management Improvement Study (JMIS) (Emmer, Sanford, Clements, & Martin, 1982). The JMIS was a field experiment conducted to verify and extend findings of previous research on classroom management in English and mathematics classes. A total of 61 teachers in a variety of subject areas in Grades 6 through 8 participated in the experimental study. All of the science classes in the JMIS form the sample for the present descriptive study.

Background

Research in the past 10 years has demonstrated links between teacher behaviors, student task engagement, and achievement (Emmer & Evertson, 1981; Evertson & Emmer, 1982; Frederick & Walberg, 1980; Good, 1982; Stallings, Needels, & Stayrook, 1979). Relatively few studies have examined classroom management variables in secondary science classes, however. A recent study by McGarity and Butts (1982) examined relationships among teacher classroom management competence, student engagement, and achievement in science classes. The authors used 12 management behavior variables to derive a classroom management competence factor. Results showed that teachers' management competence is related to both student engagement and science achievement.

A study by Newton and Capie (1982) examined relationships between different modes of student engagement and science process skill achievement. Significant relationships were found for 6 of 12 on-task categories. Teacher behaviors associated with differences in student engagement or off-task behavior were not a focus of the study.

One study that did examine teachers' management activities in science classes was conducted by Nuccio (1982). Using mean class time spent in instruction as the sole criterion of effective management, the author described more and less effective teachers' responses to various managerial events. Other studies have suggested that class time use is a relatively poor predictor of student achievement, compared to student engagement or teachers' management practices (Frederick & Walberg, 1980; Sanford & Evertson, 1983).

At the Research and Development Center for Teacher Education at the University of Texas, a series of studies of classroom management included a descriptive study of 102 junior high school English and mathematics classes (Emmer, 1981; Evertson & Emmer, 1982). Classroom observations were conducted throughout the school year to find out how effective teachers establish well managed classes at the beginning of school and maintain them throughout the year. The study identified several important areas of classroom management behavior. These results were used in designing a subsequent study, the Junior High School Management Improvement Study (Emmer et al., 1982). Inclusion of a variety of content areas in the JMIS provided opportunity to examine effective management practices for classroom tasks and activities associated with different content areas.

Statement of the Problem

The present study of management in 26 junior high and middle school science classes was designed to answer the following questions:

(1) What classroom management practices are related to high levels of student on-task behavior and low levels of off-task and disruptive behavior in science classes? To what extent are these teacher practices/student behavior relationships similar to or different from those in the JMIS sample as a whole?

(2) What similarities and differences exist between management practices used by more and less effective managers in this sample with regard to (a) general classroom procedures and

organization of activities, (b) conduct of laboratory (hands-on) activities and small group work, (c) management of student assignments and keeping students responsible for their work, and (d) content presentations?

Method

Sample

All of the science classes in the JMIS formed the sample for the present study. The teachers were volunteers from two urban school districts in two southwestern cities. Most were eighth grade teachers with fewer than 3 years of experience. Three were in their first year of teaching, while one teacher had 7 years of experience. All of the classes were heterogeneous or "average ability" classes.

Data Sources and Instrumentation

Each teacher was observed in two classes beginning the first week of school and extending through February, with emphasis on the first 2 months of the school year. Between 16 and 18 observations were conducted during the first 8 weeks of school and eight additional observations were made during the month of January and February, making a total of about 25 observations per teacher. Observations extended through entire class meetings, and observers were assigned to teachers so that at least two different observers saw each teacher separately on several occasions during the first 8 weeks and during January and February. For 4 of the 13 science teachers, however, no observations were made during January and February because 3 taught half-year courses and 1 left the school during the year.

Observer Training. Classroom observations in the JMIS were made by 20 trained observers. Observer training took place during the week prior to the beginning of data collection, and included 2 1/2 days of in-class training and additional out-of-class assignments. Observers received explanations of the background and purpose of the study, as well as guidelines and directions for using the observation instruments. Training activities included reliability checks, practice with videotapes of classroom instruction, and other types of practice exercises.

Instrumentation. A variety of data were collected in the classrooms. Narrative records were used to gather qualitative data about classroom activities and behaviors of both teachers and students. During each observation, an observer wrote a description of classroom events on the narrative record form. The observer was asked to preserve the sequence of activities, noting teacher and student behaviors and recording as many direct quotes as possible. The length of the narrative record varied, depending upon the complexity of the classroom setting, behaviors, and activities, as well as the skill of the observer in recording details of classroom life. Manuscripts for an observation in the study typically ranged between six and nine pages. Training procedures emphasized gathering information about dimensions relevant to management variables while still allowing observers to note and record other details of classroom life.

On-task rates and the amount of unsanctioned, off-task student behavior, two important dependent variables in the study, were assessed using the Student Engagement Rate (SER) instrument. Beginning at a randomly determined time during the first 10 minutes of each observation, and thereafter every 10 minutes, observers stopped taking notes for the Narrative Record and used the SER form to record the number of students in the class who were engaged in academic or procedural activities or who were off task, in dead time, or unobservable. Observers recorded approximately five assessments on the form during each observation. SER counts were converted to proportions by dividing the number of students in each category by the

number of observable students present. A score for each category in each observation was obtained by calculating the average of the SERs during that observation. Each time an SER was completed, the observer also recorded the type of activity and the lesson format so that later analysis of these data by format or activity type is feasible.

Two reliability checks were made. During training, observers used the SER to assess engagement for several videotape lesson segments, and their assessments were compared to experts' (experienced staff) assessments. Another check on reliability was provided in 28 paired observations, in which a staff member accompanied an observer and both recorded SERs during a live observation. This was done on 28 occasions. Intraclass correlations were calculated to estimate the percent of variance of each variable that was reliable. Reliability for major SER categories (On task, Academic; On task, Procedural; Off task, Unsanctioned; Dead time) ranged from 0.83 to 0.96.

After each observation, the Component Rating (CR) scales were used by the observer to assess teacher and student behavior in a number of variables relating to instructional management, rules and procedures, meeting student concerns, managing misbehavior, and classroom climate. These 5-point scales were defined in detail in a coders' manual. Student behaviors assessed with the Component Ratings included the level of disruptive behavior, inappropriate behavior, and task-oriented behavior, variables used as dependent measures (in addition to on-task and off-task rates).

Estimates of reliability of the Component Rating variables were derived from observations in weeks 2 through 8. Because each teacher was seen by two or more observers, an estimate of agreement between observers can be obtained by comparing the observers' ratings. Each observer's Component Rating scores were averaged across the observations made of the teacher. These observer averages were compared using intraclass correlations for each variable. It is important to note that these coefficients represent both the reliability of observers as well as stability over time so that these coefficients are an estimate of the generalizability of the variables. The data indicated that most of the CR variables were reliable at the 0.01 significance level. Those that did not exhibit significant reliability were not used.

At the end of the first 8 weeks of observations, a set of summary Observer Ratings of Teachers (ORTs) was made by observers who had seen a teacher on at least three occasions. The purpose of the ratings was to gather information about teaching behavior and activities that might require several observations to assess, or that were expected to occur relatively less frequently than most variables assessed on the Component Ratings. The reliability of the observer summary ratings was determined by comparing the ratings made by different observers of the same teachers. About three fourths of the ORT variables achieved significant observer agreement. Only these variables were retained for further analyses.

Analysis

To answer the question regarding relationship of science teacher management behaviors and student on-task, off-task, and disruptive behavior, partial correlations controlling for treatment or control group membership were computed between the student behavior criteria and teacher management behaviors derived from classroom observations and narrative analysis.

In addition, to describe and illustrate management and organization practices used by more and less effective teachers in the sample, the 13 teachers were ranked on eight management effectiveness criteria, based on observation data from the first 2 months of school. The 8 management criteria consisted of the 3 student behavior criteria used in question 1, and 5 variables taken from the Component Rating (CR) instrument:

(1) Student on-task proportion
(2) Student off-task unsanctioned proportion
(3) Disruptive student behavior rating
(4) CR 3b, Appropriate general procedures
(5) CR 1k, Consistently enforces work standards
(6) CR 5d, Consistency in managing behavior
(7) CR 1d, Teacher gives clear directions
(8) CR 1h, Appropriate pacing of the lesson

Narrative records of classroom observations for teachers were read and summarized. In addition to general aspects of management, teacher summaries were prepared of any available information about three specific aspects: management of hands-on or laboratory activities, content presentation and student note taking, and management of long term assignments such as research reports. Narrative records also provided information about time use and activity patterns in the 13 classes.

Results and Discussion

Management Variables and Student Behavior

Correlation of classroom management and instructional organization variables with student behavior criteria identified a large number of teacher practices significantly related to high levels of task engagement and freedom from disruption in science classes. Tables showing results for all variables are included in the full report of the study (Sanford, 1983). Table I lists selected variables and correlation coefficients relating to four areas of management: classroom procedures and rules, student work procedures, management of student behavior, and organization and presentation of instruction. Discussion of these and related variables follows.

Classroom Procedures and Rules. Procedural variables showing the strongest significant relationships with the effective management criteria in science classes include appropriate general procedures, efficient administrative routines, efficient opening and closing classroom routines, frequency of students calling out for teacher's assistance (negative), and effective small group procedures. Correlation coefficients for these variables range from $r = 0.68$ to 0.95. Managing interruptions efficiently, having procedures that enable students to get help without interrupting the teacher, and effective teaching of procedures and rules to students are also significantly ($p \leqslant 0.05$) related to one or more of the student behavior criteria.

Student Work Procedures. In the area of procedures governing student assignments, strong correlations ($r = 0.69$ to 0.91) were obtained for several variables: consistently enforcing work standards; suitable routines for assigning, checking, and collecting work; and effective routines for communicating assignments. Fewer or no significant correlations were obtained for variables describing different types of academic feedback.

Managing Student Behavior. In the area of managing student behavior, key management variables identified by earlier management research (Emmer, 1981; Evertson & Emmer, 1982) and in the JMIS (Emmer et al., 1982) were supported by strong correlations with student behavior variables in science classes. Teachers' *consistency* in responding to student misbehavior, effective monitoring, stopping inappropriate student behavior quickly, and avoidance of student wandering in the classroom all showed high correlations ($r = 0.67$ to 0.95) with the three management success criteria. Few significant correlations were obtained for any specific response to inappropriate or disruptive behavior or for rewarding appropriate behavior.

TABLE I

Correlation of Selected Classroom Management Variables
with Student Behaviors

Variable Description	Off-task	On-task	Disruptive Behavior
Efficient administrative routines (CR3a)	-.87	.81	-.85
Appropriate general procedures (CR3b)	-.95	.76	-.92
Efficient small group procedures (CR3c)	-.83	.46	-.64
How often do students call out when they need help (ORT13)	.89	-.68	.76
Consistently enforces work standards (CR1k)	-.91	.73	-.89
Suitable routines for assigning, checking, and collecting work (CR3d)	-.88	.74	-.81
Rewards appropriate behavior (CR5b)	-.10	-.40	-.16
Consistency in managing behavior (CR5d)	-.94	.73	-.89
Effective monitoring (CR5e)	-.92	.67	-.84
Stops inappropriate behavior quickly (CR7c)	-.95	.73	-.94
Ignores inappropriate behavior (CR7i)	.82	-.62	.78
How often does wandering occur that is not task related (ORT3)	.93	-.83	.86
Describes objectives clearly (CR1a)	-.75	.67	-.76
Clear directions (CR1d)	-.81	.77	-.84
Teacher waits for attention (CR1e)	-.92	-.67	-.92
Appropriate pacing of lessons (CR1h)	-.82	.78	-.78
What is the efficiency of transitions (ORT6)	-.89	.72	-.84
Does teacher consistently plan enough work for students (ORT18)	-.84	.61	.80

TABLE I (*Continued from previous page*)

Variable Description	Off-task	On-task	Disruptive Behavior
How confident is this teacher (ORT34)	-.78	.68	-.75
How enthusiastic is this teacher (ORT36)	-.36	.10	-.31

CR = Component Ratings; AdCR = First Week Addendum Component Ratings; ORT = Summary Observer Ratings of Teachers.

A single underscore indicates $p < 0.05$; double underscore indicates $p < 0.01$.

$n = 13$ teachers.

Organizing and Presenting Instruction. Another set of variables in this study assessed teachers' behavior with regard to organizing and pacing instructional activities and presenting information. Based on consistent significant correlations, the most important variables in this area are describing objectives clearly, clear directions, waiting for students' attention before giving directions, appropriate pacing of lessons, clear explanations and presentations, planning appropriate amounts of work for the class period, and efficient transitions. Correlation coefficients for these variables and the student behavior criteria range from 0.61 to 0.89. Significant ($p \leqslant 0.05$) correlations for three additional variables underscore the importance of pacing and accommodating student abilities and characteristics: student success rate (a global rating of apparent class frustration levels or ability to comply with assignment directions), student attention spans considered in lesson, and monitoring student understanding.

Miscellaneous Variables. A small number of the personal teacher characteristics were assessed in this study. The only one significantly related to student behavior is confidence, shown in Table I. As measured in the present study, teachers' enthusiasm, showmanship, warmth, listening skills, and distracting mannerisms appear to be unrelated to the classroom management success of this sample of 13 teachers.

Describing Effective Management Practices

The second analysis procedure undertaken after observations had ceased consisted of ranking the 13 science teachers on each of the eight effectiveness criteria listed in the methods section and summing ranks. This procedure resulted in the identification of three distinct groupings: a group of 3 best managers, 7 middle group teachers, and 3 low manager group teachers. Table II presents a comparison of means for the three subgroups of teachers for the eight management variables. Best group and low group teachers were consistently higher or lower than most teachers on most management variables. In the remainder of this article, classroom procedures and activities in classes taught by more and less effective managers will be described and contrasted. Discussion will be organized around five important aspects of science classroom activity: general classroom procedures, time use and activities, laboratory and hands-on activities, student work procedures, and content presentation, including student note taking.

General Classroom Procedures. Of the 3 teachers in the best manager group, 2 used similar approaches to classroom management and procedures while 1 used a less structured but equally effective system. With the exception of some ambiguity in Teacher B 1's policies on student call outs and out-of-seat behavior, the three best teachers had procedures that effectively governed student talk, participation in oral lessons and discussion, getting out of seat, checking or turning

TABLE II

Comparison of Means for Three Subgroups
of Teachers on Eight Effectiveness Criteria

Variable	Best Group ($n = 3$)	Middle Group ($n = 7$)	Low Group ($n = 3$)	Range, All Teachers ($n = 13$)
Percent students off task, unsanctioned	2%	4%	13%	1%-18%
Percent students on task	94%	87%	80%	77%-96%
Disruptive student behavior*	1.11	1.39	2.48	1.00-3.18
Appropriate general procedures (CR3b)*	4.55	3.79	2.36	1.71-4.60
Consistently enforces work standards (CR1k)*	4.20	3.42	1.98	1.53-4.33
Consistency in managing behavior (CR5d)*	4.36	3.44	1.96	1.47-4.53
Clear directions (CR1d)*	4.36	3.90	3.00	2.65-4.50
Appropriate pacing of lessons (CR1h)*	4.33	3.62	2.54	2.38-4.50

*Ratings based on 1-5 scale.
Means based on 16-18 observations during 8 weeks in the fall.

in work, what to do when work was finished early, and ending the class. At the beginning of the school year, all three teachers clearly explained their expectations for student behavior during class, and then followed their presentations with review and reminders of policy in subsequent weeks. In all three classes teachers gave clear, simple directions and were noted as excellent in structuring transitions. They kept students apprised of time left for an activity; they forewarned the class of up-coming transitions; they brought one activity to an end before beginning another. They also told students what materials would be needed for an activity, and had students get materials ready before beginning.

In the three best managers' classes, students were generally expected to work quietly when doing individual assignments and only brief whispered exchanges between students were permitted. During lab assignments and when students were assigned to work in pairs or groups, talk was allowed. The three best managers monitored student behavior closely, circulating around the room to look at students's work. Even when these teachers worked at their own desks, they were accurate in quickly spotting off-task students.

Consequence systems (e.g., demerits and detention after class or rewards for good behavior or work) were much more visible in classes of Teachers B 1 and B 2 than in classes taught by Teacher B 3. Teacher B 3 seldom used (or appeared to need) any kind of penalty, with the exception of one mention of "points off," and he used no rewards other than grades. Teachers B 1 and B 2 used a system of demerits and detention after school consistently and fairly,

although minor inappropriate behavior was usually stopped quickly by all three teachers by reminding students of what they were supposed to be doing, saying the student's name, or asking for silence. These three teachers' manner in conducting class was task oriented, and businesslike, although congenial.

In contrast, in six classes taught by teachers in the low manager group, procedures and routines governing major areas of classroom life were frequently missing. For example, in classes taught by Teacher L 2 there were no routines established for beginning and ending the period, student talk during seatwork, getting help from the teacher, or what to do when work was finished. All three teachers were noted as making fairly clear (although not comprehensive) presentations of classroom procedures and rules at the beginning of the year, but they provided little or no review or reminders afterward. All three presented elaborate consequence systems that were seldom or never enforced. Two of the 3 poor managers were poor monitors of student behavior and work, often seeming unaware of whether students were doing their work or misbehaving. All three teachers had difficulty conducting transitions from one activity to another. They often did not bring one activity to an end before giving directions for another. They gave directions without getting students' attention, and they seldom forewarned the class or helped students structure their time.

Class Time Use and Activities. Analysis of activity codes recorded on classroom narrative forms failed to show differences between more and less effective managers' classes with regard to total instructional time, when instructional time is defined as proportion of class time in which the teacher and/or the majority of students are involved in an academic activity such as content presentation or discussion, seatwork, small group work, or testing. Teachers varied widely with regard to proportion of class time in different activities, such as whole class instruction, student activities, and transition time. There was as much variation within groups as between, however. Two of the most effective managers had the lowest proportions of class time spent in whole class instruction. Students in their classes spent more time in individual or group tasks. This was not the pattern in the third more effective manager's classes, however. The middle group of managers had a lower group mean on student activities than the other two groups did, but this group included both the highest (0.51) and lowest (0.11) proportions in the sample. Finally, despite their poor control of student behavior, the low manager group did not have a higher mean proportion of class time spent in transition. (Time per transition may have been longer in these classes, but these teachers may have attempted fewer activities per class and so had fewer transitions.)

Thus, proportion of class time spent in different activities does not appear to be a productive way to look at junior high classrooms (see also Sanford & Evertson, 1983). Total instructional time is a less important variable than appropriateness, pacing, and accountability of instructional activities and student engagement rates. The three best managers in this sample of science teachers were characterized as having a lot of work for students to do in class, and students were held accountable for it.

Laboratory Activities

Narratives of class meetings with hands-on activities provided many illustrations of the difficulties that some teachers encounter in trying to conduct such activities. Laboratory activities conducted by poor managers were often characterized as chaotic, with very little work accomplished by students. Students often did not appear to listen to or follow teachers' instructions. Classes were very noisy and many students were rowdy. Teachers ignored most off-task and inappropriate behavior, while trying to help individuals. In contrast, laboratory activities in classes taught by the three best managers usually ran smoothly and efficiently. These teachers

defined the task clearly for students, prepared materials and established procedures that allowed students to work with a minimum of confusion and delay, and monitored students' work closely. Periods of teacher assistance or instruction for individuals or small groups were usually brief, so that the teacher could maintain awareness of all students' behavior. Students were orderly and talk was mostly task related. To illustrate management practices associated with such good work environments, the procedures that Teacher B 2 used for laboratory activities are described below.

> Students worked in pairs for most laboratory activities, and partner assignments were made by the teacher. On the day of a lab (or sometimes on the day before) instructions were provided on a worksheet and on the chalkboard or overhead. The teacher went over objectives of the lesson, the grading criteria, and the procedures listed on the board and lab worksheet. If the laboratory activities consisted of several major parts, she suggested time allotments for each part to help students pace themselves. New words or terms used on the worksheet were defined. Materials were ready before students needed them. Two separate supply stations were often used to avoid congestion.
> During laboratory activities, the teacher circulated around the room to check on students' work and answer questions. Students were expected to raise their hand if they needed help and to stay at their work station unless it was necessary to get supplies. While students worked, the teacher gave several reminders about time, providing a 10-, a 5-, and a 2-minute warning before clean up. If students finished their work early, they were instructed to check over their worksheet to make sure it was complete and neat, ask for more lab activity instructions, or read the references listed for the day's lesson. To allow plenty of time for clean up, the teacher often set a kitchen timer. Immediately after clean up, the teacher had students return to their desks. She usually conducted a quick discussion of results and gave them a report on their performance during the lab.

Student Work Procedures. In classes taught by more effective managers, there were very clear work requirements, good monitoring of student progress on assignments, and frequent checks of daily work and quizzes in class. One of the 3 teachers in the low manager group had adequate accountability procedures in place and tried to monitor student work. In classes taught by the other less effective managers, however, there were poor and inconsistent procedures for assigning, collecting, and checking work, and little monitoring of student progress or completion of assignments.

The beginning class routine used by two of the best managers helped students and teachers keep track of assignments. Students were held accountable for copying each day's assignment and schedule of activities into their notebooks. A permanent record of these "plan of the day" descriptions for each 6 weeks was also maintained on display in the room, so that students who were absent from class could assume responsibility for their own make-up work. In all three of the best managers' classrooms due dates for assignments were not routinely extended or ignored. Students were penalized in some way for late work.

From both the teachers' and the students' points of view, one problematic aspect of work procedures at the junior high and middle school level is management of relatively long term assignments such as research papers or projects. In this study procedures used by more effective managers to help their students succeed on long term assignments included: assigning individual topics (to help students get started quickly and to adjust difficulty of assignments for different students); providing written, detailed description of requirements for form, content, due dates; using several intermediate check points (approval of students' list of references, examination of

notes or outlines); providing examples of acceptable projects and checklists of requirements or grading criteria.

Content Presentations. In almost all of the classes in the sample, much science content was presented to students through means other than oral explanation by the teacher. Often students read from a text or a handout, wrote answers to questions or definitions of terms, or completed some kind of worksheet. Class discussion focused on and reinforced content of these assignments. Frequency of oral content presentations in which students were expected to take notes ranged in this sample from 2 observations out of 24 to over half of the observations for several teachers.

More effective and less effective managers were similar in that they usually helped students take notes during content presentations by writing essential facts on an overhead transparency or on the chalkboard. Good managers were different from less effective ones in that their presentations and explanations were clearer, their directions about note taking were explicit and firm, and they held students accountable for notes that were supposed to have been taken. Less effective managers were more often vague about expectations for note taking (e.g., "This is something you should maybe put down in your notes.") and less likely to check students' notes.

Several teachers in the best manager and middle manager groups had their students keep a note section in their notebook. Before a presentation they usually told students to get out the notebook, turn to the notes section, and date the paper. During presentations these teachers wrote down facts, sometimes in outline form, on an overhead transparency or on the chalkboard as they discussed points and checked for student understanding by questioning students and asking them to define terms used in the notes. Students' notebooks were checked periodically. Some teachers showed students examples of good notes and pointed out strategies to use, such as underlining important words. On several occasions two effective managers requested students to put their notes on the upper corner of their desk immediately following a presentation, and then circulated around the room looking at students' notes.

Summary and Conclusion

Using student behaviors (on-task, off-task, and disruptive behavior) as primary criteria of management effectiveness, this study has investigated classroom management practices in 26 classes taught by 13 junior high and middle school teachers. Extensive classroom observation provided information about management practices associated with smooth running, task oriented classrooms. Effective management practices for general classroom procedures, laboratory procedures, managing student assignments, presenting content, and structuring note taking were briefly described and illustrated.

For the most part, the pattern of teacher and student behavior relationships found in science classes are similar to those reported for junior high classes in other content areas (Emmer et al., 1982; Evertson & Emmer, 1982). The skills required to manage science instruction are *not* significantly different from those characteristic of competent teachers in other secondary subject areas, although the complexity of some science class activities and content requires special attention to some aspects of management. Thus, in junior high science classes efficient procedures and routines, skill in managing group work, quickly stopping inappropriate behavior and wandering, clear communication, and appropriate pacing of instructional activities seem to be especially important.

Student task engagement and class freedom from disruption were used as criteria of effective management in this study. Although these criteria are not in themselves indicators of effective teaching or learning, research in elementary and secondary classrooms has provided ample evidence that maintaining student cooperation and attention to tasks is a necessary, though not

sufficient, condition for effective teaching to take place. In addition, researchers such as Anderson and Barufaldi (1980) and Doyle (1979) have demonstrated that management concerns have impact on teachers' decisions about instructional activities. Science teachers are faced with many management-related decisions as they plan and conduct their classes each day. Studies such as the present one are useful if they help teachers, teacher educators, and supervisors to be aware of important aspects of management or provide a framework for thinking about or observing classroom practices and their effects on students.

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