

Teaching Mathematics and Social Studies in Junior and Senior High School: An Analysis of Verbal Teaching Behaviors

MARCELLA L. KYSILKA *
O. L. DAVIS, JR.

DECISIONS about the substantive content (for example, information, problems, skills) appropriate to the components of professional education are a major concern of teacher education programs. These decisions are particularly critical with respect to both general and specific courses in teaching methodology. Several questions illustrate the dimensions of the general problem. What dimensions of teaching are general or common to all fields? Which dimensions of teaching are unique, specific, or "special" to each field? What realistic differences exist between junior and senior high school teaching and how best may teacher candidates develop expertise as they aspire to teach at one or the other level?

Obviously these questions have not been ignored. For decades they have occupied the attention and talents of imaginative and inspired teacher educators. Nevertheless, a dearth of empirical data related to these questions has resulted in debatable program and course construction. Expert opinion seems to have been the only usable alternative in curriculum development. Several points illustrate the general problem. Little is known about the effectiveness of most teaching techniques for secondary school teachers, both at junior and senior high school levels, even though experienced classroom teachers assert that teaching at these

two levels is radically if not totally different. Research in the area of special procedures ("techniques") for special subjects is virtually nonexistent; yet, teachers claim that certain techniques are more applicable to one teaching field or educational level than another. Competing and unverified claims seem not to offer reasonable promise of reward. Appeal to less prescriptive assertions and more descriptive conclusions seems necessary.

Verbal behaviors of teachers are one of a number of important sets of factors that should be identified for descriptions of teaching. They are emphasized because some recent research has shown (for example, Flanders, 1960; Smith and Meux, 1962) that the major component of the teaching act is verbal discourse. Smoot (1968) has suggested that several critical decisions related to course content in the preservice professional sequence are dependent upon knowledge of teachers' verbal behaviors related to the various teaching fields. If beginning teachers are expected to identify and exhibit a range of teaching behaviors and plan

* Marcella L. Kysilka, Assistant Professor of Education, Florida Technological University, Orlando; and O. L. Davis, Jr., Professor of Curriculum and Instruction, The University of Texas at Austin

strategies of behaviors appropriate for different situations, then generalizations based upon extensive research on teacher behaviors of teachers working in different fields and grade levels seem imperative (Flanders, 1960). Until data are available on how teachers actually behave in the classroom, predictions about how teachers "ought" to behave cannot logically be made (Medley, 1967). Consequently, this study was conceived as one venture to provide appropriate and relevant data for consideration of "the way it is" in teaching at two secondary levels and in two teaching fields.

Most studies of teaching seem to have concentrated on describing teacher behavior independent of the teaching field and the educational level of pupils. Several studies (for example, Giammatteo, 1963; Amidon and Giammatteo, 1965; Castelli, 1964; Bogener, 1967) conducted in elementary schools have contrasted teacher behavior at different grade levels and in different curricular fields. Furst and Amidon (1967), additionally, reported that primary teachers talked more in social studies than in any other subjects, while middle and upper elementary teachers talked more in arithmetic (except in sixth grade, where most teacher talk was in social studies). Only a few studies at the secondary level seem directly related to the present interest. Wood (1969), using Flanders' Interaction Analysis, found no significant differences in a comparison of the verbal behaviors of mathematics and English teachers. Cockrum (1967) noted that secondary social studies student teachers were more indirect than science student teachers. With such an inadequate research base, appropriate suggestions are seriously limited with respect to the inclusion or exclusion of teaching tasks, information, or activities in various teacher education components.

Purpose

The specific purpose of this study was to describe and to differentiate, if possible, the verbal behaviors of junior and senior high school mathematics and social studies teachers. Mathematics and social studies were

selected for examination because they seem to be two distinctly different substantive fields. By observing and analyzing the teaching behavior patterns of experienced secondary school teachers in social studies and mathematics, those verbal behaviors common to both fields and those distinct to each field (hopefully) could be isolated.

Hypotheses

The basic hypotheses of this study were: (a) There are no differences between the verbal teaching behaviors of eighth and eleventh grade mathematics teachers; (b) there are no differences between the verbal teaching behaviors of eighth and eleventh grade social studies teachers; (c) there are no differences between the verbal teaching behaviors of eighth grade mathematics and eighth grade social studies teachers; (d) there are no differences between the verbal behaviors of eleventh grade mathematics and eleventh grade social studies teachers; and (e) there are no interactions between the verbal behaviors of teachers due to grade level or teaching field.

Procedure

The plan of the study was, first, to observe experienced classroom teachers teaching at the eighth and eleventh grade levels in mathematics and social studies; and second, to examine the observation records for common and unique verbal teaching behaviors.

Twenty-four secondary teachers constituted the subjects of this study. There were six teachers in each of four groups: teachers of eighth grade mathematics, teachers of eighth grade social studies, teachers of eleventh grade mathematics, and teachers of eleventh grade social studies.

The teachers had a minimum of one year of experience, had previously taught the subject, now were teaching in schools of comparable socioeconomic levels (middle to upper-middle class white schools), and had classes in which the students were of comparable intelligence (mean IQ's for the four groups were 111, 113, 114, 116).

Eighth and eleventh grade social studies classes were studying American history. The eighth grade mathematics classes were focusing on pre-algebra, while the eleventh grade classes were studying geometry or second-year algebra.

The instrument used to record the teachers' verbal behavior was the Observation Schedule and Record 5V (OSCAR 5V) developed by Medley *et al.* (1968). This is an 18-category system which is designed to describe a teacher's verbal behavior. The original OSCAR (Medley and Mitzel, 1958) was reported to be highly reliable. Seven observers gathered data for this study. After 16 hours of training the median inter-observer reliability was calculated to be .76, with no score below .60.

Teachers were observed four times during an eight-week period; observations were made approximately every 10 days. Observers began recording behaviors after the opening five minutes of class time. The last 15 minutes of each class were not recorded as

this served as a study time in the majority of the classes.

The teachers knew which weeks, but not specific days they would be observed. They were aware that the observers were recording teacher-pupil interaction. Teachers were instructed not to prepare "special" activities, but to continue with the normal classroom routine.

Criterion data were 21 OSCAR 5V category scores, each calculated as a percentage of the subject's total verbal behavior, and seven ratio scores. These 28 scores individually were subjected to analysis of variance procedures employing the CDC 6600 computer program AVAR 23 (Veldman, 1967).

Findings

Results of the analyses of variance of the OSCAR 5V category scores are summarized in Table 1. The finding of no significant interactions indicates that teachers in the two teaching fields did not have differential behaviors at different grade levels. Only one significant difference between grade levels was noted. Eighth grade teachers used significantly more ($p < .10$) directing statements than did eleventh grade teachers.

Nine significant differences in the contrasts of the teaching fields were observed. Mathematics teachers asked more ($p < .05$) convergent and ($p < .01$) procedural positive questions and used more ($p < .05$) directing statements than did social studies teachers. On the other hand, social studies teachers employed more ($p < .05$) rejecting statements and ($p < .05$) divergent questions than did the mathematics teachers. This number of significant differences (5 of 21) was itself significant (Sakoda, Cohen, and Beall, 1954). The four significant differences at the .10 level indicate: students in social studies classes made more nonsubstantive statements and volunteered more substantive information than did students enrolled in mathematics classes; social studies teachers used more desisting statements

OSCAR scale	Between grade levels (MS) (df = 1)	Between teaching fields (MS) (df = 1)	Interaction (MS) (df = 1)	Within (MS) (df = 20)
PNS	1.490	6.531 (F = 3.41; $p < .10$)	1.101	1.917
PQU	1.581	.028	1.197	3.236
PST	.721	71.830 (F = 3.70; $p < .10$)	21.282	19.429
PRS	2.018	1.701	1.021	1.279
PBST	8.284	.851	11.648	9.118
CVG	2.727	15.666 (F = 4.79; $p < .05$)	2.594	3.271
EL1	.324	11.413	2.930	8.755
EL2	4.550	.788	.885	1.816
DVG	.077	3.745 (F = 6.48; $p < .05$)	.400	.578
NOEV	4.310	2.413	8.604	8.179
CNSUP	.021	.116	.105	.237
INF	114.756	132.258	152.914	67.042
DSC	10.205	48.025 (F = 3.40; $p < .10$)	1.080	14.138
DIR	38.532 (F = 4.10; $p < .10$)	51.832 (F = 5.52; $p < .05$)	1.701	9.389
RBCRT	.297	.490	.408	.965
DST	.043	.085 (F = 2.87; $p < .10$)	.022	.030
PRNSQ	.840	.549	.592	1.281
PR+	.435	23.741 (F = 32.80; $p < .01$)	1.691	.724
AP	3.929	.555	2.864	5.145
AC	5.549	4.472	8.616	4.438
REJ	.213	3.375 (F = 4.65; $p < .05$)	.049	.725

Table 1. Summary of Analyses of Variance of Observed Verbal Behaviors of Teachers (OSCAR 5V Categories)

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and fewer describing statements than did mathematics teachers.

Table 2 summarizes the analyses of variance of the ratio scores. No significant interactions nor grade level differences were observed. Mathematics teachers had higher ($p < .05$) Teacher Talk/Total Talk and lower ($p < .05$) Pupil Initiated Talk/Teacher Talk ratios than did social studies teachers. Social studies teachers had higher ($p < .10$) Divergent/Convergent Question and ($p < .10$) Elaborating 2/Elaborating 1 Question ratios than did mathematics teachers.

Discussion

The findings of this study generally indicated that there were few significant differences in the verbal teaching behaviors of eighth and eleventh grade mathematics and social studies teachers. Consequently, with respect to the observed behaviors, the validity of the claim that teaching mathematics is different from teaching social studies must be held suspect as well as the assertion that the teaching style of junior high school teachers differs from the teaching style of high school teachers.

Results of this study indicate that the overall or predominant pattern of verbal teaching behavior of teachers of both social studies and mathematics, at both eighth and eleventh grades, is that of lecturing and short questions and answers. This evidence seems to be contradictory to what is being advocated by the newer curriculums in the fields of mathematics and social studies.

Differences between junior and senior high school teachers' verbal behaviors were practically nonexistent. These findings contradict the thought that teaching early adolescents is different than teaching older adolescents (Faunce and Clute, 1961). A possible explanation could be that little, if any, distinction is made in the teacher preparation programs for these two levels of teaching.

However explained, these findings remain uncomfortable. They are inconsistent

Ratios	Between grade levels (MS) (df=1)	Between teaching fields (MS) (df=1)	Interaction (MS) (df=1)	Within (MS) (df=20)
Teacher Talk/Total	.002	.020 (F=5.11; $p < .05$)	.001	.004
Soliciting/Informing	.028	.054	.144	.073
Pupil Talk/Teacher Talk	.002	.039 [†] (F=4.82; $p < .05$)	.007	.008
Divergent/Convergent	.248	.660 (F=3.12; $p < .10$)	.037	.212
Elaborating 2/ Elaborating 1	.062	.282 (F=2.81; $p < .10$)	.008	.100
Nonsubstantive/Total	.000	.001	.000	.001
Indirect/Direct	.028	.077	.173	.109

Table 2. Summary of Analyses of Variance of OSAR Ratios for Verbal Behaviors of Teachers

with the conventional wisdom of teaching in practice and teacher preparation programs.

Caution is suggested in generalizing and interpreting these results. The number of teachers in each of the subgroups was small and was determined in order to control for general socioeconomic level of students in the schools, the need to secure sufficient data on the subjects by obtaining a minimum of four observations on each subject, and the availability of both teachers and observers. Too, rapport of some observers with a few teachers was difficult to establish and this situation may have influenced those teachers' classroom behaviors to an unknown degree in undetermined ways. This study, like others in the tradition of which it is a part, gives only an incomplete picture of the amount of time the teacher is involved in teaching; activities were not observed (for example, testing, using films) which did not reveal the teacher's verbal behavior. The OSAR 5V is selective of the verbal behaviors which may be classified; that is, some, at times critical, verbal teaching behaviors are missed (for example, the number of different students called on to answer a question). Therefore, conclusions and interpretations are restricted to the language of the observation system. A possibly major limitation is that there was no control for topic variance. Conceivably, different topics within a teaching field enable the teacher to vary significantly his verbal behavior. To reduce the possible effects of this problem, observations were distributed over an eight-week period

in order to sample adequately teachers' normal verbal teaching behaviors.

This research should be considered as an initial effort to identify specific and unique verbal teaching behaviors in different teaching fields and at different grade levels. Certainly, future study should contrast be-

haviors of teachers specifically prepared for junior high and senior high teaching. Direct attempts to alter patterns of teaching in the several teaching fields may yield real differences in the ways teachers teach. Prescriptions based on empirical data obtained from descriptions of teaching seem not yet possible.

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