Pausing Phenomena: Influence on the Quality of Instruction

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This report summarizes work of 7 years on the influence of a variable called "wait-time" on the development of language and logic of children taking part in elementary science programs. Analysis of over 300 classroom tape recordings showed mean pauses to be on the order of 1 sec; that is, after a teacher asked a question, students had to begin a response within an average time of 1 sec. If they did not, the teacher typically repeated, rephrased or asked a different question, or called on others. A second wait-time is involved: when a student makes a response, the teacher normally reacts or asks another question within an average time of 0.9 sec. This study investigates the consequences of manipulating both species of wait-time. When mean wait-time of 3-5 sec is achieved through training, analysis of more than 900 tapes shows changed values on eight student variables: (1) the length of response (number of words) increases, (2) the number of unsolicited but appropriate responses increases, (3) failures to respond decrease, (4) incidence of speculative responses increases, (5) incidence of student-student comparisons of data increases, (6) incidence of evidence-inference statements increases, (7) frequency of student-initiated questions increases, and (8) the variety in type of verbal moves made by students increases. Servochart plots of recordings show that students discussing science phenomena tend to speak in bursts, with intervals of as much as 3-5 sec between bursts being fairly common provided they are not interrupted. The average post-student-response wait-time of 0.9 sec apparently intervenes between bursts to prevent completion of a thought. The classroom is conceptualized as a two-player game in which the quality of inquiry will tend to improve when there is a better equity in the distribution of moves between the players. The teacher is treated as one player and the collection of students as the second player. Changes in wait-time shift the game toward a more equitable state.

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Over time, a classroom or instructional group on the prolonged wait-time schedule undergoes certain spontaneous changes. Two teacher variables change: (1) response flexibility scores increase, and (2) teacher questioning patterns becomes more variable. There is some indication that teacher expectations for performance of students rated as relatively slow improves.

INTRODUCTION

In recent years, researchers in the area of communications have exhibited considerable interest in the function that pauses serve in spontaneous speech (see the review by Rochester, 1974). In problems arising from applied situations, the attention of the researcher is compelled toward major variables. Teaching is a case where pausing phenomena may be studied in natural settings and then experimentally manipulated in order to examine how their duration and location influence values of other variables such as the length of student statements and the complexity of student expression. It appears from the investigations reported herein that manipulation of the duration of pauses located in two positions may be especially relevant to the attainment of certain objectives of instruction. Changes in the duration of pauses in two locations in the exchanges between teachers and students in modern elementary science programs alter the value of eight student outcome variables, contribute to changes in two others, and appear to be related to two subsequent changes in teacher variables. (In other words, the system is dynamic.)

ORIGIN OF THE PROBLEM

Virtually all of the major elementary science programs extant today were designed to provoke children to inquire about relationships among natural phenomena. All of them provide situations intended to be suitable for the development in children of certain skills and a viable knowledge structure. The programs provide provocative stimuli meant to provoke inquiry. But the people who prepared the programs frequently admitted that the amount and quality of inquiry actually occurring in classrooms fell well below

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2 Over the past decade, the United States government has funded curriculum development in the sciences mainly through the National Science Foundation. For schools participating in the trials of these new programs, all of the material for instruction was supplied. Programs were developed through the joint effort of scientists, science educators, psychologists, and teachers.