COLLEGE OF THE VIRGIN ISLANDS

DOES THE INDIRECT VERBAL BEHAVIOR OF A HIGH SCHOOL BIOLOGY TEACHER INCREASE THE SCORES WHICH STUDENTS MAKE ON THEIR WRITTEN TEST?

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CHAPTER I

INTRODUCTION

In a period wherein marked changes in students, teaching styles, and society are occurring, research into teachers' verbal behavior is imperative. The behavior of the teacher not only influences the cognitive development of students, but students' attitudes as well.

Analyzing student achievement in a verbal instructional setting will be an invaluable aid in determining the effectiveness of the instructional methods, materials, and objectives. Poor student progress may be an indicator of a less than desirable quality of teaching, or it may indicate the need for change in instructional strategies.

Statement of the Problem

Interaction analysis studies by Flanders, Amidon and Hunter, demonstrate that lecturing, giving directions and criticizing activities, having what they call direct influences, tend to restrict pupil participation. Verbal behavior such as asking broad questions, clarifying, making use of the students' ideas, accepting feeling, praising, or encouraging student behavioral activities, having what they call indirect influence, tend to increase student participation. Many science education authorities feel the new curriculum in science lends itself to a greater use of indirect teacher influence in the classroom. Is this happening?

Flanders demonstrated that the behavior of the teacher not only influences the cognitive development of students, but their attitudes as well. The problem is to find out whether the indirect verbal behavior of a high school biology teacher increases the scores which students make on their written test.

Significance of the Problem

Verbal interaction analysis data can assist biology and other teachers in making a more comprehensive assessment of their teaching behavior, which may in turn generate a desire for change or improvement. This study should have an impact on those teaching, preparing for teaching, or those supervising teachers.

Objective

To determine if the indirect verbal behavior of a high school biology teacher influenced scores which students made on their written achievement tests.

Hypothesis

The scores of biology students exposed to an indirect verbal influence will show an increase over those exposed to a direct verbal influence.

Basic Assumption

Teachers can be helped to define accurately their own concepts of desirable or ideal teacher behavior and modify this behavior in the direction of their ideal.

Definition of Terms

Indirect teacher behavior.

Accepts feeling - accepts and clarifies the feeling tone of the sutdents in a non-threatening manner.

Praises or encourages - praises and encourages students action or behavior.

Accepts or uses ideas of students - clarifying, building or developing ideas or suggestions by a student.

Ask questions - asking a question about content or procedure with intent that student answers.[1]

Direct teacher behavior.

Lecture - giving facts or opinions about content or procedure; expressing his own idea; asking rhetorical questions.

Gives directions - directions, commands, or order with which a student is expected to comply.

Criticizes or justifies authority - statements intended to change student behavior from non-acceptable to acceptable patterns: bawling someone out, stating why the teacher is doing what he is doing, extreme self-reference.[2]

Student Talk.

Student talk response - talk by students in response to teacher. Teacher initiates the contact or solicits student statement.

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[1]Edmund J. Amidon and Ned A. Flanders, The Role of the Teacher in the Classroom. (Minnesota: Paul S. Amidon and Associates, Inc. 1963), p. 12.

[2]Ibid.

Student talk-initiation - talk by students which they initiate

Silence or confusion - pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.[3]

Verbal Behavior - primarily involving classroom talk, which takes place between teacher and pupils, and occurs during certain definable activities.

Written Achievement test - refers to subject matter content in terms of knowledge and understanding of basic science concepts and principles.

Biology Lane II - students with average grades of "C" and placement based on teacher recommendation.

Trained observer - a person who has learned all the steps of Flander's Interaction analysis process and has developed consistence and reliability in categorizing teacher behavior.

[3] Ibid

RESEARCH DESIGN

This was an experimental study. The problem was to find out whether the indirect verbal behavior of a high school biology teacher increased the scores which students make on their written tests.

Sample

The 80 subjects for this experimental design were selected on the basis of their teacher's recommendations, and an average grade of "C". A list of student's names were given to the registrar. At the end of the school year, twenty students registered, for general biology and were assigned by the registrar to one of the four sections of Lane II Biology at Charlotte Amalie High School, Saint Thomas, Virgin Islands. The same teacher taught the four classes of twenty students each. Two of the classes were control groups and were instructed by using the direct approach. The other two classes were the experimental classes and were instructed by using the indirect approach.

Procedure

The biology teacher role played the direct and indirect verbal influence. The Flanders' Summary of Categories Interaction Analysis[4] was used by the biology teacher to clarify indirect and direct verbal behavior. An analysis of the classroom verbal influence of the teacher was made by a trained observer. The observer coded the teacher-pupil interaction using Flanders' Summary of Categories Interaction Analysis. The observer visited the teacher's four classes once a week for eight

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[4]Ibid.

successive weeks and coded the teacher-pupil interaction on the spot, and the entire discourse was recorded on audiotape for future use. The data was processed to yield a number of matrices and interaction scores for the teacher.

Data on the perception of the teacher's verbal behavior came from the completion of a checklist by the students on how they perceived their teacher's verbal behavior at the end of the experiment.

A standardized pretest[5], designed to assess the student's achievement in biology, was administered to the four classes of Lane II Biology, the second week, of September.

On Monday of the following week, one hour each day, five days a week, for ninety days, after the pretest, the teacher began teaching two classes basic concepts of biology using the direct approach, for one hour each day. The subject matter was the same, only the approach was different.

At the end of the instructional period, a different form of the same standardized test, a posttest was given to the four classes of Lane II biology by their teacher.

Analysis

Individual student profiles were made from both tests to facilitate immediate feedback on the different individual student's scores. The means and standard deviation were compared in order to establish the difference between the two test scores, and to determine if there were any increase in the pretest and the posttest scores.

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[5]Dr. B.R. Whittenger, Achievement Examinations for Secondary Schools Biology Form 4, University of Minnesota High School, Bobbs-Merrill Co. Inc.

Hypothesis

That, following 90 hours of instruction in general biology, classes exposed to an indirect verbal behavior teaching influence will show gains greater than students in general biology classes exposed to a direct teaching influence. Their posttest scores on a standardized achievement test will show an increase over the direct control group.

Delimitations of Study

This study was delimited to 10th grade Lane II biology students and their teacher at the Charlotte Amalie High School, Saint Thomas, Virgin Islands. Flander's interaction matrice technique was used, this technique does not analyze all teacher effectiveness, only an aspect of student-teacher verbal behavior. This study is concerned only with verbal behavior.

Existing groups were used, therefore, the variables of age, aptitude and intelligence were not taken into consideration when the students were assigned to the various groups.

One trained observer was used. This was the experimenter, a disinterested, but trained, second person was needed to eliminate a potential source of bias.

CHAPTER II

REVIEW OF RELATED LITERATURE

In our society, the authority to direct the learning activities of the student is given to the teacher. The students expect the teacher to take charge, to initiate learning activities, and to contribute information as needed in the learning process. What the teacher does with this power makes a great deal of difference in the cognitive and affective development of students.

The review of literature in this chapter is on research into a teacher's verbal behavior and its influence on students' cognitive development. The literature centers on teacher-pupil interaction analysis and research in the classroom using the instruments developed by Flanders.

A study of the teacher's role in the classroom was made by Edmund J. Amidon and Ned A. Flanders. The purpose of this study was to show the relationship between teacher influence patterns and the achievement and attitude of students. The study also showed the effect of direct and indirect teacher influence on student achievement. The teacher's verbal behavior was defined as direct or indirect.

During the first year of study by Flanders, the concepts of teacher influence and goal perception were used with eighth grade students in four experimental treatments in each of two areas, geometry and social studies.

These four treatments were created in a laboratory situation:

1. Direct influence with goal clarity.
2. Direct influence with goal ambiguity.
3. Indirect influence with goal clarity.
4. Indirect influence with goal ambiguity.

In each subject area a teacher role-played both direct and indirect teacher influence. Several classroom experimental groups of 20 students each were involved in each treatment, with a total of 560 students participating in the geometry and 480 students in the social studies experiments.[1]

The second year of the research project involved a field study that tested the same relationship as those tested in the first-year laboratory experiment. There were 900 students participating, half was seventh-grade social studies and half eight-grade geometry students. The 32 teachers, 16 in each subject area, were the regular classroom teachers.

The following conclusions were reached:

1. Indirect teachers acted most indirectly when goals were being clarified and when content material was being introduced and acted most directly after goals had been clarified and work was in progress.

2. Several students of the most direct teachers learned less as measured by written achievement test than students of indirect teachers.

3. In both content areas the students of the more indirect teachers scored higher on the achievement test than students of the more direct teachers.[2]

This study implied that teachers who are qualified in some content area should be exposed to some type of human relations training to help them attain the following objectives:

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[1]Edmund J. Amidon and Ned A. Flanders, The Role of the Teacher in the Classroom, (Minnesota: Paul S. Amidon and Associate, Inc., 1963), p.55.

[2]Ibid., p.56.

1. The ability to use the social skills of accepting, clarifying, and using the ideas of students in planning work and diagnosing difficulties.

2. Knowledge of those acts of influence that restrict students reactions and those that expand student reactions.

3. Understanding of a theory of instruction that can be used to control teachers' Behavior in guiding classroom communication.[3]

Parakh utilized modifications of the observational techniques developed by Flanders for the study of teacher-pupil interaction in biology classes. Parakh divided his study into two phases to meet his two major objectives:

1. To develop a reliable category system for firsthand systematic observation of teacher-pupil interaction in high school biology lecture-discussion-recitation classes and laboratory classes.

2. To classify, describe, and analyze the teacher-pupil interaction in high school biology classes.[4]

Classes of ten high school biology teachers from seven secondary public schools in central New York State were observed. Teachers with 2 to 9 years of teaching experience were included from small rural and fairly large urban school districts.

One lecture class and one laboratory class of each of the ten teachers were observed once a week for 4 successive weeks. During each observation visit, the teacher-pupil interaction was categorized or coded on the spot and the entire discourse was also recorded on audiotape for future use.

Data were processed to yield a number interaction matrices and interaction scores for each teacher. However, only composites of average figures are reported. He found the following:

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[3]Ibid., p. 61.

[4]Jal D. Parakh, "A Study of Teacher-Pupil Interaction in High School Biology Classes." (Ph.D. dissertation, Cornell University, 1965), p. 5.

1. The "average" or "composite" teacher talked 75% of the total time in lecture-discussion classes and about 50% of total time in the laboratory.

2. The average teacher devoted relatively little time to motivational aspects such as praising, encouraging, and accepting student performance and ideas - about 7% in lectures and 3% in laboratories.[5]

This study should have an impact for those studying biology teaching or those preparing for biology teaching. Broad generalizations about biology teaching cannot be drawn from such data, but a challenge for change speaks out in the research report.

A procedural behavior checklist was developed by refining the Kochendiefer Biology Classroom Checklist and a verbal Interaction Checklist from the instruments of Flanders; Amidon, Hunter, and Parakh by Alex Pogerski and Burton Voss.

Ten public high school biology teachers and a class section under each teacher constituted the sample for this study. All teachers in the study were men; the students in the 10th grade were boys and girls.

Data on the perceptions of the teacher's instructional behavior came from three sources: the complete checklist of teachers on how they perceived their verbal and procedural behavior; the completion of the checklist by the students on how they perceived their teacher's verbal and procedure behavior; and the analysis of the classroom verbal interaction by a trained observer.

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[5]Ibid., p. 14

The data were analyzed at the University of Michigan computer center to determine coefficients of correlation and its values for differences. The kinds of behavior reported were statistically significant at the 0.05 level.

There was 87% agreement between the teachers' perception of the same behavior. The ratio of indirect to direct verbal influence, based on significant correlation coefficients, was 1 to 6. Teachers perceived their verbal behavior to be six times more indirect than direct; however, the students did not agree with these perceptions.

The interaction analysis data indicated that the average teacher did the following:

1. Talked 61.68% of the total classroom time and 42.76% of the total laboratory time.

2. Spent little time in accepting, praising or encouraging student's ideas (4.19% in the classrooms and 2.64% in the laboratory).

3. Spent more time in the classroom lecturing, evaluating, and making comparison (11.96%, 4.19%, and 18.24%, respectively, in the classroom and 2.91%, 3.11%, and 3.48% in the lab).

4. Almost never made explicit statements about the nature of science (0.19% and 0.0%, respectively, in the classroom and 0.6% and 0.0% in the lab.[6]

David Cronk wanted to determine if six elementary school principals from one community who enrolled in a Flanders Interaction System (FIAS) course during the summer of 1967, changed the frequency of their references to verbal behaviors when producing annual written evaluations

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[6] Alex Pogerski and Burton Voss, "Evaluating the Biology Teacher's Behavior in the Classroom", The American Biology Teacher 34 (May 1972), pp. 279-281.

of their teachers.

> The data for the study were derived from 293 written annual evaluations of 112 teachers produced by these six principals over a six year period. These references noted were divided into two groups, those written during the three years preceding and the three years following the principals' enrollment in the FIAS course. The contents of the annual written evaluations of teachers were initially categorized into two types of references, those concerning verbal behaviors and others. The 274 references to verbal behaviors so obtained were futher classified among ten categories defined for FIAS and a miscellaneous category. From the numerical frequencies thus obtained (with conversions in some instances to percentages) it was possible to make a number of comparisons, for example, among principals and among years. To determine if these were significant differences to teachers' and pupils' verbal behaviors for the three-year period previous to the FIAS course enrollment and the post three-year period, a Chi-square test was employed.[7]

A major finding from this study showed that when a group of selected elementary school principals become knowledgeable about the Flander's Interaction Analysis System (FIAS) they increase their number of written references to teachers' and pupils' verbal behavior.

The purposes of a study done by Dr. Richard J. McLeod were:

1. To identify non-random changes which occur in the verbal patterns of student teachers of science who are trained in the Flander's System of Interaction Analysis.

2. To search within these verbal patterns for changes that are related to the verbal patterns of their cooperating teachers.

3. To compare the findings of this study with those of a study control group not trained in the Flander's technique.

Twelve student teachers in secondary science were observed and their verbal interaction coded using the Flander's System

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[7] David Ross Cronk, "Analysis of Principals' References to Verbal behaviors in Written Evaluations on Teachers", Dissertation Abstract, Vol. 33A (1972), p. 99.

of Interaction Analysis, for a total of six class periods. After the initial two observations were completed, the student teachers were given approximately ten hours of instruction in the Flander's System of Interaction Analysis. Six class hours of their cooperating teachers were also observed and coded by means of the Flander's Technique, as they taught the same group of pupils that had been taught by their student teachers.[8]

Secondary science student teachers who had been trained in interaction analysis differ significantly from a control group not thus trained in the following respects:

1. They experience more non-random changes in their verbal patterns.

2. They experience more non-random changes toward indirect teacher influence and fewer non-random changes toward direct teacher influence.

3. They use more indirect teacher influence and less direct teacher influence.

4. They are more likely to change their verbal patterns in relation to their cooperating teachers, and these changes are more likely to result in the student teachers' becoming more like their cooperating teachers than less like them.[9]

Perks wanted to find answers to the following questions:

-When administrative policies, laboratory facilities, the economic level of the students' background, the curriculum, and the basic science text are controlled, what is the relationship between junior high school student achievement on recall of factual information and ability to make application to knowledge, and the amount of academic preparation of their science teachers?

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[8] Dr. Richard J. McLeod, "Changes in the Verbal Interaction Patterns of Secondary Science Teachers Who Have Had Training in Interaction Analysis and the Relationship of These Changes to the Verbal Interaction of Their Cooperating Teachers", Dissertation Abstracts, Vol. 28 (1967), p. 144.

[9] Ibid.

-Do behaviors incorporated in the Science Teaching Observation Instrument vary directly and positively with student achievement on recall of factual information and ability to make application?

-Do teachers with different amounts of credit in science differ in the frequency and kinds of behaviors they display in their teaching?[10]

The entire junior high school science faculty within a single school district, (32 science teachers), made up the population for the study. The background information about teachers was collected from school records, and included the number of credits earned in science courses, in method of teaching science, recentness of course work in science, grade point average in science, and total years of teaching experience. Their teaching behaviors were evaluated using the Science Teaching Observation Instrument (STOI).

The STEP Science Test 3A was used to measure ability to make application of knowledge of junior high school general science in new context. Information on student intelligence was obtained from scores on the California Test of Mental Maturity.

Students were grouped by the teacher and within each of these groups by sex and intelligence levels-lower third, middle third, and upper third. The main score for each group was determined. Below are listed the findings:

1. Difference among students' scores on recall of factual knowledge of science and ability to make application could not be significantly (.05) related to the academic preparations in science of their junior high school science teachers.

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[10] Dr. Victor Aston Perks, "Junior High School Teacher Preparation, Teacher Behaviors, and Student Achievement", Dissertation Abstracts, Vol. 28 (1967), p. 146.

2. No significant correlations could be found between the frequency a teacher displayed each of the several kinds of behavior studied and the amount of academic credits junior high school science teachers earned in science.[11]

Teachers whose students scored higher on factual information were relatively older, had fewer credits in methods of teaching science, had lower GPA's in science, and had less recently completed a college level science course. Teachers with high grade point averages in sciences, those with more credits in methods of teaching science, and teachers who had more recently completed a college level science course were related to higher student application scores and lower factual scores. Teachers with these backgrounds displayed more frequently those behaviors associated directly (.05) with higher student application scores and less frequently with those behaviors associated with higher factual knowledge scores. They held student discussions more frequently, and less frequently lectured, summarized, and explained; they had students actively participate more frequently in activities such as demonstrations and less frequently conducted demonstrations themselves.

Thomas P. Evans presented a paper to the National Association for Research in Science Teaching on March 8, 1970. The purposes of the Evans paper were to:

1. Present a description of the Flander's System and a discussion of its strengths and limitations.

2. To review research on science teachers effectiveness which employed the Flander's System to measure classroom interaction.

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[11] Ibid.

3. To provide recommendations for further research.[12]

Listed below are the strengths and limitations pointed out by Evans:

1. It provides an objective method of distinguishing teacher behavior from teacher characteristics.

2. It attempts to describe rather than to evaluate teacher-learning situation.

3. The use of the matrix to analyze data.

Additional strengths follow: (1) the sequence of events are preserved, permitting a study of the ongoing classroom interaction as it evolves; (2) the system is relatively easy to learn and to use; (3) the categories and procedures are defined in such a way that independent observers, after a period of training, are able to reach a high level of inter-coder agreement; and (4) the system is not restricted to any particular subject area or grade level.[13]

Major limitations of the Flander's System as pointed out by Evans are:

1. Its failure to include nonverbal behaviors.

2. The failure to provide student-interaction.

3. Failure of the system to make allowances for differences or extremes within each category.

4. The use of ground rules to eliminate disagreements.[14]

Evans analyzed ten studies, and concluded that the relationship between teaching styles, as measured by the Flander's System, and science teachers were far from being clear.

He made eight recommendations, and stated if these were implemented, the likelihood of identifying certain aspects of science teacher effec-

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[12] Thomas P. Evans, "Flander's System of Interaction Analysis and Science Teacher Effectiveness" (Arlington, Virginia: Eric Document Reproduction Service, ED 059094, 1970), p. 1.

[13] Ibid., p. 2.

[14] Ibid., p. 2

tiveness could be improved. (1) Researchers should have some assurance that teachers who participate in teacher effective research know what the criterion instruments purport to measure and agree upon these measures as legitimate objectives of their science teaching. (2) Researchers should not consider the results of applying the system to science classrooms as a complete description of teacher-pupil reaction. (3) Researchers should apply more than one category system to the same teaching-learning situation. (4) Researchers should report their investigation in a more accurate and complete manner. (5) Comprehensive reviews of original research documents could result in a major contribution to teacher effectiveness research. (6) Researchers should analyze the classroom behavior of teachers until they have definitely identified indirect and direct group of science teachers. (7) Researchers should create new paradigms on teacher effectiveness which include classroom behavior, teacher environmental, pupil and criterion variables. (8) Researchers should investigate the effects of teacher-pupil interaction on differential rather than on heterogeneous groups of students.[15]

Evans' recommendations can be used by science educators as a framework in their research work. It was pointed out that Flander's System can be a useful instrument if it is used correctly.

A workshop was started during the fall of 1966, by A.A.C.T.E. (American Association of Colleges for Teacher Education), that included the components of Interaction Analysis, Nonverbal Analysis, and Microteaching. It was called Skill Development in Teaching Model of (SKIT).[16]

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[15] Ibid., p. 8.

[16] Edmund Amidon, "Interaction Analysis and Microteaching Skill Development in Teaching", ED 036 469-69 (1969), p. 1.

The SKIT model can be used to develop specific behavioral skills in both teaching improvement programs for inservice teachers and teacher education programs for teacher trainees. First, an adequate knowledge of the interaction categories is needed to be able to associate the category number with the behaviors included in the categories. Then, the participant role plays a teacher using specific categories and category combinations upon request.[17]

In the SKIT model categories in the modified Interaction Analysis System were used. Each category was broken into two to four subcategories. The subcategories were developed from an expanded Interaction analysis system by integrating some of the work of Marie Hughes, Hilda Taba, and James Gallagher, with work done in Interaction Analysis at Temple University.

Four kinds of data collection are used in the SKIT model:

1. Data expressed in a category system for behavioral observations.
2. Videotape or audiotape recordings of the microlession.
3. Perceptions of the participants who play the role of the students.
4. Perception of the supervisor. Immediate feedback comes from the collection of the four types of data.[18]

This SKIT model seems to be the answer to many of the questions that have been difficult to answer in teacher education in the Virgin Islands. Interaction analysis and microteaching combined could provide a framework

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17 Ibid., p. 2

18 Ibid., p. 4.

for increasing almost any verbal or nonverbal teaching skill.

To determine if a measurable relationship could be found between students gains in critical thinking and the teacher's level of self-actualization, Charles R. Coble[19] tested 424 biology students in September and again in early April with the Watson-Geaser Critical Thinking Appraisal Form ZM. The biology teachers - 18 in all - were administered Shostrom's Personal Orientation Inventory (Shostrom, 1966), an inventory for the measurement of self-actualization.

The biology teachers were divided, for analysis, into two groups based upon significant and nonsignificant changes that occurred in their students critical-thinking abilities. Group I was composed of eight teachers selected on the basis of significant changes that occurred in their critical-thinking abilities; Group II was composed of 10 teachers whose students evidenced a nonsignificant change in critical thinking.

The teacher in Group I may be described as behaving more on the basis of internal motivation than on the basis of external influences. His behavior was characterized by a normal degree of flexibility in the application of their values and in the exercise of good judgment. The most distinctive characteristic of teachers in Group I was his expression of good interpersonal relationship. Teachers in this group measured above the norms on the Personal Orientation Inventory (POI) in interpersonal sensitivity - an important characteristic for teachers desirous of establishing a helping relationship in the classroom.

The teachers in Group II might be characterized as excessively concerned with the past or future, relative to the present. In the area of

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[19] Charles R. Coble, "Self-Actualization and the Effective Biology Teacher", The American Biology Teacher 35, (November 1973): 479-481.

interpersonal sensitivity, they measure below the norms on the Personal Orientation Inventory (POI) in their ability to cultivate class relationships with other people.

It would be highly premature to suggest, on the basis of this study that measures of teacher self-actualization are predictors of teacher success. There does appear to be justification for further research to determine the relative effectiveness of biology teachers, as well as teachers of other disciplines and related to other variables of students progress.

Will small-group procedures in Junior high school lead to increased achievement, more positive student attitudes and better peer relationship? Robert J. Starr and Carolyn D. Schuerman[20] hypothesized that there is no significant difference in achievement in seventh-grade life science between students who were taught by lecture-discussion (large-group made) as measured by a teacher constructed achievement test while statistically controlling for (a) prestudy attitude, (b) IQ and (c) pretest achievement scores.

This study took place in a large junior high school in St. Louis County, Missouri, which enrolled approximately 1,500 students, mainly middle class, in grades 7-0. The study was completed during the spring semester, 1971. Two seventh-grade life science classes, taught by one instructor, were randomly selected for the experiment.

The length of time spent studying the unit was three weeks. During the course of the study, all classes received similiar material; the only

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[20]Robert J. Starr and Carolyn D. Schuerman, "An Experiment in Small-Group Learning", The American Biology Teacher 36 (March, 1974): 173-175.

variable was the mode of teaching and learning, with the experimental classes in small-group discussion while the control class received the usual large-group lecture discussion.

The design of the experiment was a pretest post test control group with random selection of intact classes. The data were analyzed by means of a computer program.

Achievement scores for the two groups was similar. However, the experimental students' mean achievement was higher than that of the control pupils when adjusted for IQ or preachievement or preattitude, or combinations of these factors. The experimental students seemed more negative toward the lecture method than the controls, who had a slightly lower IQ.

The review of the literature centered on teacher-pupil interaction and it made clear that teachers must delicately balance their selection of teaching approaches if they are to improve both cognitive achievement and student attitudes toward learning. None of the studies reviewed concluded that any one pattern of teacher behavior was superior to another under all conditions. The effective teacher attempts to vary his approach, and certain types of objectives demand different approaches that are effective for him. The teacher must know when to give praise or reproof, and how to lead students to the proper interpretation of the course. Interaction analysis enables teaching to become visible and concrete so that teachers can really see and understand what they are doing as they teach.

It was brought out in Flander's study that students of the indirect teacher learn more as measured by an achievement test than students of the direct teacher. Also that all types of students learn more working with the more indirect teacher than with the more direct teacher. Dr. Perks,

in his study of Junior High School Teacher Preparation found that teachers who held student discussions more frequently, and lectured, summarized and explained less, had students that made higher application scores and lower factual scores on their achievement tests. These teachers had high grade point averages in science; more credits in methods of teaching science, and had recently completed a college level science course.

Many research students were oriented to student achievement thus pre-tests and posttests were given, and pupil changes in achievement were reported in an attempt to prove or disprove a hypothesis. This thesis was developed using this design, a pretest was used to measure the amount of understanding the students had of the biology subject matter before the treatment, of a direct and indirect teaching approach, the posttest was used to measure how much learning the students had achieved as a result of the indirect and direct teaching approach of general biology. A review of the preceding studies provided the background for this study.

CHAPTER III

DATA AND ANALYSIS

The purpose of this chapter is to present the analysis of the data collected from the instruments administered to the students, and the instrument measuring indirect and direct influence.

The following information will be presented in this chapter:

1. The presentation and analysis of the data on the indirect and direct verbal influence of the teacher.
2. The presentation and analysis of the checklist completed by students on the perception of the teacher's verbal behavior.
3. The pre-test and post-test scores made by students on the Biology Achievement Examination for Secondary Schools.

Analysis of the Indirect and Direct Verbal Influence of the Teacher.

The technique used to record the sequence of classroom events using Flander's Interaction Analysis consist of entering the sequence of numbers into a 10 row by 10 column table, called a matrix. The generalized sequence of the teacher-pupil interaction can be examined readily in the matrix. The following coding procedure was used:

1. A thorough knowledge of the ten categories for interaction analysis so that response is automatic.
2. Observer sat in classroom for several minutes to get some idea of the general climate before recording.
3. Keeping as steady a tempo as possible, the observer wrote down one category number every five seconds to code the interaction observed in the preceding five seconds interval for forty-two minutes.
4. Observer write down the tabulations in the cells of the observation matrixes from the observation record.

5. A description of the classroom interaction based on the tabulations found in the cells of the observation matrix was developed.

TABLE I

FLANDER'S SYSTEM OF INTERACTION ANALYSIS

CATEGORIES FOR INTERACTION ANALYSIS

TEACHER TALK	
INDIRECT INFLUENCE	1. "ACCEPTS FEELING: accepts and clarifies the tone of the students in a non-threatening manner. Feelings may be positive or negative. Predicting or recalling feelings are included. 2. "PRAISES OR ENCOURAGES: praises or encourages student action or behavior. Jokes that release tension, but not at the expense of another individual; nodding head, or saying "go on" are included. 3. "ACCEPTS OR USES IDEAS OF STUDENTS: clarifying, building, or developing ideas suggested by a student. As teacher brings more of his own ideas into play, shift to category five. 4. "ASKS QUESTIONS: asking a question about content or procedure with the intent that a student answer.
DIRECT INFLUENCE	5. "LECTURING: giving facts or opinions about content or procedures; expressing his own ideas; asking rhetorical questions. 6. "GIVING DIRECTIONS: directions, commands, or orders to which a student is expected to comply. 7. "CRITICIZING OR JUSTIFYING AUTHORITY: statements intended to change student behavior from nonacceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.

TABLE I CONTINUED

STUDENT TALK	8. "STUDENT TALK--RESPONSE: talk by students in response to teacher. Teacher initiates the contact or solicits student statements. 9. "STUDENT TALK--INITIATION: talk by students which they initiate. If "calling on" student is only to indicate who may talk next, observer must decide whether student wanted to talk. If he did, use this category.
	10. "SILENCE--CONFUSION: pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

SOURCE: Ned Flanders, "Intent, Action, Feedback: A Preparation for Teaching", Journal of Teacher Education 14 (September, 1963).

Table I shows the ten categories that must be memorized so that an observer's responses are automatic. These categories may be employed by a teacher either as he observes someone teach or as he categorizes a tape recording of his classroom behavior. In either case, the method is the same.

TABLE 2

OBSERVATION RECORD #3

Time Minutes	Categories												Comment on Lesson
1	10	6	10	6	8	8	8	8	8	8	8	8	
2	2	4	8	8	8	8	8	8	8	8	8	4	
3	10	4	10	10	10	10	10	10	10	10	10	10	
4	5	5	9	4	8	4	8	4	8	4	4	8	
5	10	10	10	10	10	10	10	10	10	10	10	10	
6	10	10	10	10	3	3	3	5	5	5	5	5	
7	5	5	5	5	5	5	5	5	4	8	8	8	
8	4	5	5	5	4	8	5	4	5	4	4	4	
9	5	10	5	5	5	5	5	5	5	5	5	5	
10	5	5	5	5	5	5	5	5	5	5	5	5	
11	5	4	8	8	8	8	5	5	5	5	5	5	
12	5	9	9	5	10	5	5	5	5	5	9	9	
13	5	5	5	4	6	6	6	6	6	10	10	10	
14	10	10	7	7	7	7	7	9	9	9	3	3	
15	2	5	5	5	5	5	5	5	5	5	5	5	
16	5	5	5	5	5	5	10	5	5	5	5	5	
17	5	5	5	5	8	2	2	10	10	10	10	10	
18	10	10	4	6	8	2	5	5	8	8	5	5	
19	5	5	5	5	5	5	5	5	5	5	5	5	
20	5	2	2	5	5	5	5	5	5	5	5	5	
21	3	3	3	4	5	5	5	5	5	5	5	5	
22	5	5	5	5	5	5	5	5	5	5	5	5	
23	1	1	5	5	5	5	9	5	5	5	5	5	
24	5	5	5	5	5	5	5	5	5	5	5	5	
25	5	5	5	5	5	5	5	5	5	5	5	5	
26	8	2	10	10	10	10	10	10	10	10	10	10	
27	10	10	10	10	10	10	10	10	10	10	10	10	
28	10	3	3	3	9	3	9	10	10	10	10	10	
29	10	10	9	9	9	9	9	9	9	9	9	9	
30	9	9	9	9	9	9	5	5	5	5	5	5	
31	5	4	8	8	8	4	8	8	4	8	8	8	
32	4	9	8	5	5	5	5	5	8	8	8	8	
33	4	8	5	8	4	8	8	8	8	8	8	4	
34	9	9	9	9	4	8	8	4	8	8	8	7	
35	7	9	5	8	8	4	8	8	8	4	8	4	
36	8	8	4	8	4	9	4	4	8	4	8	8	
37	4	8	2	9	5	5	9	4	8	9	8	8	
38	9	9	9	9	9	9	4	9	8	4	8	8	
39	8	8	8	4	8	2	8	8	8	8	8	8	
40	8	8	9	9	9	9	9	8	8	8	4	8	
41	8	8	8	8	4	4	4	4	4	4	8	8	
42	8	8	8	8	8	8	8	8	8	4	8	10	

Table 2 shows a sample of the category numbers that were written down every five seconds to code the interaction observed in the preceding five seconds interval for forty-two minutes. Sometimes a comment was needed to explain the coding. At the end of a class observation of about forty-two minutes, the observation record consisted of about 504 category numbers written in horizontal rows.

TABLE 3

OBSERVATION MATRIX

CLASS CODE NO. D-A OBSERVER BLAKE DATE 8/15/75

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL TALLIES
1	1										1
2		1		2	3			1	1	2	10
3		2	5	1	2				1		11
4				5	6	3	1	19	4	1	39
5	1	1	1	43	104			8		4	162
6						3		4		10	17
7							5		2		7
8		4	1	17	9		1	78	1	4	115
9			3	4	6			6	43	4	66
10		1	2	1	21	1				49	75
Total Tallies	2	9	12	73	151	7	7	116	52	74	503
Percent of Total	.39	1.7	2.3	14	30	1.3	1.3	23	10	14	

Teacher Total: 51 Student Total: 33 Silence: 14

I/D = .58
i/d = 1.6

Table 3 shows a sample of the tabulations made in the matrix cells to represent pairs of numbers from the observation record. Ten was entered as the first number and the last number in the record. This number was chosen because it was convenient to assume each record began and ended with silence. This procedure permitted the total of each column to equal the total of the corresponding row. To check the tabulations in the matrix for accuracy, there should be one less tally in the matrix than there are numbers entered in the original observation record (N-1).

After the observer tabulated a matrix, he developed a description of the classroom interaction. Listed below are some of the steps used:

1. Compute the percentage of tallies in each of the columns. This is done by dividing each of the column totals, 1 through 10, by the total number of tallies in the matrix. This computation gives the proportion of the total interactions in the observed classroom situation found in each category.

2. Using the same procedure as "1", determine the percentage of total teacher talk that falls in each category. This is done by dividing the total of each category, 1 through 7, by the sum of the total number of tallies in the matrix.

3. The percentage of student talk, the total number of tallies in columns 8 and 9 is divided: by the total number of tallies in the matrix.

4. Next the observer focuses on the relative number of indirect and direct teacher statements. The total number of tallies in columns 1, 2, 3, 6, and 7 are more concerned with motivation and control in the classroom and less concerned with the actual presentation of the subject matter.[1]

The pattern of interaction which the teacher used with the class is now evident in Table 3. The teacher used 30 percent of her time lecturing,

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[1] Edmund J. Amidon and Ned A. Flanders. The Role of the Teacher in the Classroom (Minnesota: Paul S. Amidon and Associates, Inc., 1963), pp. 28-30.

category 5, this included giving facts or opinions about content or procedures, expressing her own ideas, or asking rhetorical questions.

Very little time was given for accepting feeling, category 1, 0.39 percent; or praising and encouraging students, 1.7 percent, category 2. She asked questions, category 4, and students responded, category 8. There was very little criticizing or justifying authority, 1.3 percent, category 7.

This teacher talked 51 percent of the total time of the observation and the students talked 33 percent of the total observation.

The teaching approach was more direct, I/D .58, than indirect. An I/D ratio of 1.0 means that for every indirect statement there was one direct statement. A I/D ratio of 2.0 means that for every two indirect statements, there was one direct statement, etc.

The teacher was indirect in her motivation and control in this particular classroom, i/d = 1.6. This ratio eliminates the effects of categories and gives evidence about whether the teacher is direct or indirect in her approach to motivation and control.

"The use of the Interaction Matrices and the use of Video Tape recordings is one concrete device which could be used by the supervisor during visitation to help the teacher increase his effectiveness."[2]

Table 4 shows a summary of interaction scores.

The most conspicious feature of the observed biology classes was the preponderance of teacher talk. There seemed to be very little difference between the direct and indirect teaching approach for this eight week average as noted in Table 4. There was 70 percent in the indirect experi-

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[2] James R. Marks, Emery Stoops, Joyce King Stoops, Handbook of Educational Supervision (Boston: Allyn Bacon, Inc., 1971) p. 295.

mental group I-A and 70 for I-B, while the control groups were slightly higher with D-A having 78 percent and D-B, 80 percent.

The average student talk as noted on Table 4 was higher for the experimental group than for the control group. Students in the classroom of the indirect teacher, according to this information, expressed themselves more freely.

The experimental groups I-A and I-B were taught using an indirect verbal approach; this is confirmed by the indirect/direct (I/D) ratio in Table 4. The control groups, D-A and D-B were taught using a direct approach.

TABLE 4

SUMMARY OF INTERACTION SCORES

Weeks	Groups	1	2	3	4	5	6	7	8	9	10	Teacher Total %	Student Total %	Silence %	I/D	i/d
1st	I-A	40	52	60	96	90	20	15	100	20	10	74	24	1.9	1.98	4.34
	I-B	26	36	68	115	88	15	4	124	21	6	69	28	1.1	2.28	6.84
	D-A	2	9	12	73	151	7	7	116	52	74	51	33	14	58	1.6
	D-B	19	32	40	80	165	16	16	90	36	9	73	25	1.7	.86	2.84
2nd	I-A	20	25	60	105	100	25	10	125	23	10	68	29	1.9	1.55	3
	I-B	22	27	58	120	120	17	6	110	17	6	74	25	1.1	1.58	4.65
	D-A	3	0	21	78	278	15	10	70	15	13	80	17	1.5	.336	.96
	D-B	12	10	25	80	260	20	6	50	20	20	82	14	3.9	.444	1.80
3rd	I-A	31	20	56	111	95	25	5	90	50	20	68	28	3.9	1.74	3.56
	I-B	47	16	63	95	82	40	5	81	60	14	69	28	2.7	1.74	2.80
	D-A	0	2	39	59	247	46	17	58	24	11	82	16	2.1	.322	.650
	D-B	9	10	41	51	158	65	6	103	50	10	68	30	1.9	.484	.845
4th	I-A	25	52	57	120	100	11	7	91	30	10	74	24	1.9	2.15	7.44
	I-B	42	29	61	100	90	27	12	97	35	10	72	26	1.9	1.79	3.38
	D-A	10	16	30	56	200	75	20	66	22	8	81	17	1.5	.379	.589
	D-B	6	13	51	60	169	94	10	65	30	5	80	19	.9	.476	.673
5th	I-A	28	35	51	96	90	52	3	92	48	8	71	28	1.5	1.44	2.61
	I-B	27	35	64	90	82	42	12	97	44	10	70	28	1.9	1.58	2.33
	D-A	10	13	50	60	157	100	20	55	28	10	82	17	1.9	.480	.608
	D-B	2	16	31	43	210	87	16	69	23	6	81	18	1.1	.923	.475
6th	I-A	35	30	47	114	100	50	13	95	14	5	27	22	.9	1.38	1.77
	I-B	28	59	63	99	87	23	5	89	40	10	72	26	1.9	2.16	5.35
	D-A	16	17	42	61	153	104	15	71	12	12	81	17	2.4	5	.630
	D-B	0	12	35	38	115	185	25	47	36	10	82	17	1.9	.261	.223

continued

TABLE 4

SUMMARY OF INTERACTION SCORES

Weeks	Groups	1	2	3	4	5	6	7	8	9	10	Teacher Total %	Student Total %	Silence	I/D	i/d
7th	I-A	33	21	59	95	87	25	3	90	70	20	64	32	3.9	1.81	4.03
	I-B	25	46	54	100	97	20	0	95	56	10	68	30	1.9	1.92	6.25
	D-A	5	35	36	54	140	128	20	64	14	7	83	16	1.3	.451	.513
	D-B	0	12	31	42	186	143	20	50	12	7	86	12	1.3	.243	.263
8th	I-A	35	30	44	100	85	27	2	90	70	20	64	32	3.2	1.83	3.75
	I-B	28	44	45	96	61	60	3	93	60	13	67	30	2.5	1.72	1.85
	D-A	8	13	53	57	154	112	15	54	25	12	82	16	2.4	.466	.582
	D-B	0	5	42	51	163	144	16	62	15	5	84	15	.9	.303	.293
Total For Eight Weeks																
	I-A	6.1	6.6	11	21	19	5.8	1.4	19	8	1.5	70	27.4	2.48	1.73	3.81
	I-B	7	7	12	20	18	6	1.2	20	8	1.9	70	28	1.8	1.85	4.18
	D-A	1.3	2.6	7	12	37	15	3	14	4.7	3.6	78	19	3.5	.499	.766
	D-B	1	2.7	7	11	35	19	2.9	13	5.5	1.8	80	19	1.7	.42	.962

I-A - Indirect Group 1 Experimental

I-B - Indirect Group 2 Experimental

D-A - Direct Group 1 Control

D-B - Direct Group 2 Control

Student Perception of the Teacher's Verbal Behavior

Data on the perception of the teacher's verbal behavior came from the completion of a checklist by the two classes of twenty students in the direct control group, and two classes of twenty students in the indirect experimental group. The checklist and student responses are presented in Table 6.

The control and experimental groups perceived their teacher's verbal behavior as indirect. It was shown to be more indirect in the experimental classes, I/D = 1.3 and I/D = 2.0. The control classes, I/D = 1.1 and I/D = 1.2, were less. One difference between the perception of the indirect group and the direct group was category 1 wherein 72 percent of the indirect group perceived their teacher as accepting and clarifying the feeling tone of the students in a non-threatening manner, and 52 percent of the direct group perceived this to be her verbal behavior. Category 2, praising or encouraging, showed the direct group's perception was 67 percent; but only 65 percent in the indirect group.

The greatest difference in the student's perception is category 9, giving directions, commands, or orders with which a student is expected to comply; the indirect student's perception was 55 percent and the direct group was 95 percent.

There is very little difference in the direct and indirect groups' perception of the other categories.

TABLE 6

STUDENT PERCEPTION OF TEACHER'S
VERBAL BEHAVIOR

Categories	Indirect - A 20 No. Students	%	Indirect - B 20 No. Students	%	Direct - A 20 Student	%	Direct - B 20 Student	%
1. Accepts feelings	15	75%	14	70%	10	50%	11	55%
2. Praises or encourages	11	55%	15	75%	14	70%	13	65%
3. Accepts or uses Ideas of Students	15	75%	17	85%	13	65%	16	80%
4. Ask questions	15	75%	20	100%	16	80%	18	90%
5. Lecturing	18	90%	17	85%	17	85%	16	80%
6. Giving Directions	13	65%	9	45%	18	90%	20	100%
7. Criticizing or Justifying Authority	10	50%	6	30%	10	50%	10	50%
	I/D = 1.3		I/D = 2.0		I/D = 1.1		I/D = 1.2	

The Pretest and Post Scores of the Experimental and Control Groups.

A standardized biology, Achievement Test, Examinations for Secondary Schools, was administered to four classes of Lane II Biology the second week of September as a pretest. Two classes were taught basic concepts of biology using the indrect verbal approach. This was the experimental group. The other two classes were taught using the direct verbal approach. This was the control group. The instruction lasted one hour each day, five days a week for ninety days. At the end of the instructional period, a different form of the same standardized test was administered.

Individual students' scores are given to facilitate immediate feedback. The means and the standard deviations were compared to establish the difference between the two test scores.

The following symbols are used:[3]

$\overline{X}$ = mean

X = raw scores

N = number of scores

E = Summation sign

$SX^2 = \frac{E(X-\overline{X})^2}{N}$ = variance

$SX = \sqrt{\frac{E(X-\overline{X})^2}{N}}$ = standard deviation

[3] William A. Mehens and Irvin J., Evaluation in Education and Psychology (New York: Holt, Rinehart and Winston, Inc., 1973), p. 91.

TABLE 7

SUMMARY OF MEANS AND STANDARD DEVIATIONS

	Pretest		Posttest		Mean
	M	SD	M	SD	Difference
I-A	31.65	3.7	40.9	4	9.25
I-B	32.4	4.2	38.65	5.4	6.25
D-A	29.8	3.9	33.55	4.4	3.7
D-B	26.1	4.4	31.9	5.19	5.8

From Table 7, it can be noted that the mean scores on the pretest for the indirect experiment (E) groups were higher than the direct control (C) groups on their pretest scores. This was not planned; the indirect (E) groups and direct (C) groups were picked by chance. The pretest was used to measure the amount of understanding the students had of the biology subject matter before the treatment. Individual test scores are shown in appendix C.

The posttest was used to measure how much learning the students had achieved as a result of the indirect approach in the teaching of biology. Table 7 presents the posttest means and the difference between the two mean scores. The difference represents an increase in the score from pretest to posttest. Individual gain scores are shown in appendix C. It should be noted from Table 10 that the scores of the indirect (E) groups are higher than the direct (C) groups.

The standard deviation (S.D.) is a measure of the variability or dispersion of a distribution of scores. This statistic indicates the students' degree of deviations from the means.

CHAPTER IV

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this research was to find the answer to the following question:

Does the indirect verbal behavior of a high school biology teacher increase the scores which students make on their written tests?

The hypothesis was made, that the scores of biology students, exposed to an indirect verbal influence, will show an increase over those exposed to a direct verbal influence.

The experimental method was employed in this study. The experimental students were given biology instruction by their teacher who utilized the indirect verbal behavior teaching technique. The Flander's Summary of Categories was used to clarify indirect and direct verbal behavior. Data on the perception of the teachers' instructional behavior came from two sources: the completion of a checklist by the students on how they perceived their teacher's verbal behavior, and the analysis of the classroom verbal interaction by a trained observer.

A standardized pretest, Achievement Examinations for Secondary Schools, was administered to the four classes of Lane II Biology the second week of September. For five days a week, for ninety days, after the pretest, the teacher began teaching two experimental classes concepts of biology using the indirect verbal teaching approach.

The other two classes were the control group and were taught the basic concepts of biology using the direct verbal teaching approach. The subject matter was the same, only the verbal teaching approach was different.

At the end of the instructional period, a different form of the standardized test was given to all Lane II Biology students by their teacher.

Individual student profiles were made from both tests to facilitate immediate feedback on the different individual student's scores. The difference between the two means of the test scores, was established to determine if there were any increase in the posttest scores.

THE FINDINGS

All the mean scores on the pretest and posttest for the indirect experimental group and the control group are shown below:

Groups	Pretest	Posttest	Mean Differences
I-A	31.65	40.9	9.25
I-B	32.4	38.65	6.25
D-A	29.8	33.55	3.7
D-B	26.1	31.9	5.8

An analysis of the data of the preceding mean scores indicates the following:

1. There was an increase of 7.75 points in the average of the two experimental classes' posttest mean scores of 39.78 over the average of their pretest means of 32.03.

2. There was an increase of 4.77 points in the average of the two control classes' posttest mean scores of 32.72 over the average of their pretest means of 27.95.

3. There was a difference of 2.98 in the average between the means of the experimental and control groups.

The observer focused on the relative number of indirect and direct statements, I/D Ratio, the rate of indirect to direct statements, of the indirect experimental group and the direct control group. An I/D Ratio of 1.0 means for every indirect statement there was one direct statement. An I/D Ratio of 2.0 means for every two indirect statements there was only

one direct statement, etc. The following I/D Ratios were found by the observer:

1. The average of the experimental group's Ratio was 1.79 or almost two indirect statements for each direct statement.

2. The average of the control group's I/D Ratio was .429, less than one indirect statement for each direct statement. D-A's ratio was .439 and D-B's ratio was .420.

The I/D Ratios indicated by the students' checklist for the experimental group were not much different from the observer's findings. However, there was a difference between the I/D Ratio of the observer and the students' for the control group. The findings for the students' I/D Ratio, on their perception of their teacher's verbal behavior, is listed below:

1. The average of the experimental group's ratio was 1.64. The I-A's ratio was 1.3 and I-B's ratio was 2.0.

2. The average of the control group's ratio was 1.15. The D-A's ratio was 1.1 and the D-B's ratio was 1.2.

The indirect teaching approach stimulated verbal participation by the students. The student talk (S.T.) average for the experimental group was 27.7 percent. The I-A was 27.4 percent and the I-B was 28 percent. The control group's average was 19 percent. Both the D-A and the D-B were 19 percent.

CONCLUSIONS

A review of the findings based upon the data presented in the study leads to the conclusions that follow.

The major question in this study was, do the scores of biology students exposed to an indirect verbal behavioral influence show an increase over those exposed to a direct verbal influence? Specific findings revealed that there was a mean difference of 2.98 between the averages of the experimental group and control group. The average of the experimental groups's

mean score gain was 7.75 and the average of the control group's mean gain was 4.77. The conclusion drawn is that the scores of students exposed to an indirect verbal influence will show an increase over those exposed to a direct verbal influence in biology.

A second area of concern was to determine if a teacher can be helped to define accurately his own concepts of desirable or ideal teacher behavior and modify this behavior in the direction of his ideal. The findings showed that a teacher can role-play both the direct and indirect teacher influence. The experimental indirect group had an average I/D Ratio of 1.79, almost two indirect statements for each direct statement. The control group's average I/D Ratio was .429, less than one indirect statement for each direct statement. The student checklist confirmed that the teacher can be flexible, and can shift his behavior as it becomes necessary. The experimental group's average ratio was 1.64 and the control group's average ratio was 1.15. As a result of these findings, it became clear that the concept of teacher flexibility is a major factor in determining teaching success. This leads to the conclusion that teachers can be helped to define accurately their own concepts of desirable or ideal teacher behavior and modify this behavior in the direction of their ideal. A teacher can make her behavior appropriate to the requirements of the class situation at the moment.

It was pointed out in the findings that teacher talk was high for both the experimental group and control group. The teacher talk average for the experimental group was 70 percent and 79 percent for the control group. This shows that teacher talk is greater when the direct verbal approach is employed.

The indirect teaching approach also stimulated verbal participation by the students. The student talk average for the experimental group was 27.75 percent and it was 19 percent for the control group. This confirmed

that the indirect teaching approach stimulated verbal participation by the students.

RECOMMENDATIONS FOR FURTHER RESEARCH

The results of this study seem to indicate that students exposed to an indirect verbal teaching approach in general biology showed gains greater than students in general biology who were exposed to a direct verbal teaching approach. Broad generalizations about teaching cannot be drawn from such a small sample and in such a short period of time, but a challenge for change speaks out. Further research is needed into a teacher's verbal behavior and how it can influence the cognitive development of Virgin Islands students. It is recommended that this research be replicated for one school year (180 days), by the Department of Education in all secondary schools in other subject areas in the Virgin Islands.

APPENDIX A

OBSERVATION RECORD # 1

(Biology Definitions)

I-A — 1st Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	Biology Definitions
2	4	8	2	6	4	8	2	4	8	2	2	2	1. Major fields
3	2	5	5	5	5	5	5	5	5	5	5	5	covered.
4	5	5	5	5	5	5	5	5	5	5	5	5	2. Specialized parts
5	4	10	10	10	4	6	8	5	5	8	8	5	of Biology.
6	1	1	1	1	1	1	4	4	8	8	2	2	3. Career opportuni-
7	3	3	5	5	4	4	8	8	2	4	4	4	ties in the field
8	8	3	3	3	5	4	4	8	8	2	3	3	of Biology.
9	3	4	8	8	8	3	3	4	4	8	2	2	
10	3	3	5	5	5	2	2	5	5	4	4	8	
11	8	8	8	3	3	3	4	4	8	8	8	3	
12	3	3	4	4	8	8	2	4	4	8	2	2	-Teacher questions
13	3	3	4	4	10	10	5	5	2	2	4	4	students. Students
14	8	8	4	8	5	8	4	8	8	8	8	8	giving answers, teach-
15	8	4	9	9	9	9	4	4	8	4	8	8	accepting answers.
16	8	7	7	9	7	7	8	8	4	8	2	4	
17	8	4	8	2	4	8	2	4	9	4	4	8	
18	4	8	2	9	5	5	9	9	1	1	1	1	
19	4	8	9	8	8	9	9	9	7	7	7	7	
20	7	5	5	4	4	4	9	4	8	8	8	4	Teacher talk
21	8	8	8	8	4	8	2	8	8	3	3	3	373÷503=74%
22	4	4	8	8	3	3	3	4	4	8	8	3	
23	3	4	4	8	2	3	3	4	8	3	4	4	
24	8	8	3	3	5	5	5	4	4	8	8	3	Student talk
25	3	4	4	8	2	9	9	9	9	1	1	1	120÷503=23.8% or 24%
26	1	1	4	10	4	8	3	3	9	9	1	1	
27	1	4	4	8	2	2	3	3	4	8	8	3	Silence
28	3	3	4	4	8	8	3	3	4	4	8	8	10÷503=1.9%
29	3	3	4	10	4	8	2	3	4	4	8	8	
30	3	3	6	6	5	5	1	1	1	1	5	5	I/D 248÷125=1.98
31	5	5	5	7	7	7	4	4	4	8	8	3	i/d 152÷35=4.34
32	3	4	4	8	8	4	5	5	5	4	4	8	
33	8	3	3	4	4	8	2	3	3	4	4	8	
34	8	3	3	4	4	8	2	3	3	6	6	6	
35	1	1	1	1	5	5	4	4	8	8	3	3	
36	4	4	10	8	6	6	1	1	1	1	5	5	
37	4	4	8	2	3	3	5	5	5	5	5	5	
38	5	5	5	5	5	5	5	5	5	5	5	5	
39	4	4	8	2	3	5	2	2	1	1	5	5	
40	5	5	8	2	2	2	2	1	1	1	1	6	
41	2	2	2	2	2	2	2	2	2	2	2	2	
42	2	1	1	1	1	2	5	5	5	5	5	10	

OBSERVATION RECORD # 2

(Biology Definitions)

I- B

1st Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	4	4	8	8	4	8	
2	8	4	8	2	2	2	2	5	5	5	5	5	
3	5	5	5	5	4	4	8	8	4	10	10	8	
4	8	5	1	1	1	5	5	5	4	4	8	8	
5	2	2	2	2	5	5	5	5	4	4	8	8	
6	8	4	4	4	8	3	3	3	5	4	4	4	
7	8	3	3	4	4	8	8	8	3	3	4	4	
8	8	8	3	3	3	5	5	5	5	5	5	5	
9	4	4	8	8	8	3	3	4	4	8	8	8	
10	3	3	4	4	8	8	8	4	4	8	4	8	
11	3	3	4	4	10	10	5	5	5	5	4	4	
12	8	8	4	4	8	2	4	8	8	4	10	5	
13	5	4	8	2	3	2	2	8	8	2	2	3	
14	3	4	8	2	2	9	9	9	9	7	7	7	
15	7	5	5	5	4	4	4	9	4	8	8	8	
16	4	8	4	8	8	4	8	8	8	2	3	3	Asked a question,
17	4	4	8	8	3	3	3	4	4	8	8	3	accepts answer,
18	3	4	4	8	2	3	3	4	8	3	4	4	and uses student's
19	8	8	3	3	5	5	5	4	4	8	8	3	answer.
20	3	3	9	9	9	9	1	1	1	1	5	5	
21	5	5	5	5	5	4	4	4	8	8	3	3	
22	4	4	8	8	8	5	5	5	4	4	8	8	
23	3	3	4	4	8	8	3	3	4	4	8	8	
24	8	3	3	4	4	8	8	3	3	9	9	9	Teacher talk
25	1	1	1	1	5	5	4	4	8	8	3	3	352÷503-69%
26	4	4	10	8	9	9	1	1	1	1	5	5	
27	4	8	4	8	3	3	5	5	5	5	5	5	Student Talk
28	5	4	4	8	8	3	3	2	2	1	1	5	145÷ 503=28%
29	5	4	4	8	3	3	2	9	1	1	1	1	
30	4	8	2	2	2	2	2	2	2	5	5	5	Silence
31	4	8	3	5	5	5	5	5	5	5	5	5	6÷503=1.1%
32	5	6	6	6	6	4	4	8	8	8	4	8	
33	4	8	2	3	4	8	8	2	2	2	3	3	I/D 245÷107=2.28
34	5	5	5	4	8	8	4	8	8	4	8	8	
35	4	4	8	8	3	3	4	8	3	2	2	2	i/d 130÷19=6.84
36	4	4	8	8	3	3	4	8	3	4	8	3	
37	4	8	3	4	8	3	4	4	8	8	3	3	
38	2	2	4	4	4	8	3	3	3	2	1	1	
39	1	9	1	1	4	8	3	3	3	5	5	5	
40	4	8	4	5	5	5	5	5	5	5	5	5	
41	6	6	6	6	9	9	6	6	4	4	8	8	
42	5	5	5	5	5	4	4	8	4	8	4	10	

** OBSERVATION RECORD #3

(Biology Definitions)

D-A 1st Week

Time Minutes	Categories												Comment on Lesson
1	10	6	10	6	8	8	8	8	8	8	8	8	
2	2	4	8	8	8	8	8	8	8	8	8	4	
3	10	4	10	10	10	10	10	10	10	10	10	10	- Students are using
4	5	5	9	4	8	4	8	4	8	4	4	8	some time to look
5	10	10	10	10	10	10	10	10	10	10	10	10	up the definition
6	10	10	10	10	3	3	3	5	5	5	5	5	of a word.
7	5	5	5	5	5	5	5	5	4	8	8	8	
8	4	5	5	5	4	8	5	4	5	4	4	4	
9	5	10	5	5	5	5	5	5	5	5	5	5	
10	5	5	5	5	5	5	5	5	5	5	5	5	
11	5	4	8	8	8	8	5	5	5	5	5	5	
12	5	9	9	5	10	5	5	5	5	5	9	9	
13	5	5	5	4	6	6	6	6	6	10	10	10	
14	10	10	7	7	7	7	7	9	9	9	3	3	
15	2	5	5	5	5	5	5	5	5	5	5	5	
16	5	5	5	5	5	5	10	5	5	5	5	5	
17	5	5	5	5	8	2	2	10	10	10	10	10	
18	10	10	4	6	8	2	5	5	8	8	5	5	
19	5	5	5	5	5	5	5	5	5	5	5	5	-Teacher is explaining
20	5	2	2	5	5	5	5	5	5	5	5	5	something students
21	3	3	3	4	5	5	5	5	5	5	5	5	do not understand.
22	5	5	5	5	5	5	5	5	5	5	5	5	
23	1	1	5	5	5	5	9	5	5	5	5	5	
24	5	5	5	5	5	5	5	5	5	5	5	5	
25	5	5	5	5	5	5	5	5	5	5	5	5	
26	8	2	10	10	10	10	10	10	10	10	10	10	Students looking up
27	10	10	10	10	10	10	10	10	10	10	10	10	definitions.
28	10	3	3	3	9	3	9	10	10	10	10	10	
29	10	10	9	9	9	9	9	9	9	9	9	9	Teacher talk.
30	9	9	9	9	9	9	5	5	5	5	5	5	261÷503=51%
31	5	4	8	8	8	4	8	8	4	8	8	8	
32	4	9	8	5	5	5	5	5	8	8	8	8	Student talk.
33	4	8	5	8	4	8	8	8	8	8	8	4	168÷503=33%
34	9	9	9	9	4	8	8	4	8	8	8	7	
35	7	9	5	8	8	4	8	8	8	4	8	4	Silence
36	8	8	4	8	4	9	4	4	8	4	8	8	74 - 503=14%
37	4	8	2	9	5	5	9	4	8	9	8	8	
38	9	9	9	9	9	9	4	9	8	4	8	8	I/D 96÷165=58
39	8	8	8	4	8	2	8	8	8	8	8	8	i/d 23÷14=
40	8	8	9	9	9	9	8	8	8	4	8	8	
41	8	8	8	8	4	4	4	4	8	4	8	8	**Sample used as
42	8	8	8	8	8	8	8	8	8	4	8	10	Table 2

OBSERVATION RECORD #4

(Biology Definitions)

D-B 1st Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	4	8	2	2	4	8	8	2	1	1	1	4	
3	4	8	2	3	4	8	8	2	2	4	8	2	
4	5	5	9	4	8	4	8	8	4	8	4	8	Biology definitions
5	2	2	3	3	9	10	10	10	10	10	10	10	
6	4	8	4	8	2	2	3	3	3	5	5	5	
7	5	5	5	5	5	5	5	5	4	8	8	8	Students are using
8	4	5	5	5	4	8	5	4	5	4	4	4	some time to look
9	5	5	5	5	5	5	5	5	5	5	5	5	up definitions.
10	5	5	5	5	5	5	5	5	5	5	5	5	
11	5	5	4	8	2	4	8	3	3	3	5	5	
12	5	5	9	9	5	5	5	5	5	5	9	9	
13	5	5	5	4	6	6	6	6	1	1	1	1	
14	1	1	1	7	7	7	7	9	9	9	4	8	
15	2	5	5	5	5	5	5	5	5	5	5	5	
16	5	5	5	5	5	5	5	5	5	5	5	5	
17	5	5	5	5	4	8	2	2	1	1	1	1	
18	9	9	9	4	8	2	3	4	8	8	5	5	
19	7	7	7	7	5	5	5	5	5	5	5	4	
20	4	8	2	2	5	5	5	5	5	4	8	8	
21	3	3	3	4	8	2	3	3	3	5	5	5	
22	5	5	5	5	5	5	5	5	5	5	5	5	
23	5	5	5	5	5	5	9	5	5	5	5	5	
24	7	7	7	7	5	5	5	5	5	5	4	8	
25	3	3	3	5	5	5	5	9	9	6	4	4	
26	8	2	2	1	1	1	1	4	8	2	2	4	
27	8	2	3	3	4	8	2	1	1	4	8	2	
28	3	3	3	3	9	4	8	3	3	4	8	3	
29	4	8	3	3	3	9	9	9	9	9	10	9	-Two students speaking.
30	9	9	9	9	9	5	5	5	5	5	5	5	Teacher talk
31	5	4	8	4	4	8	8	4	8	2	4	8	368÷503=73%
32	4	8	2	5	5	5	4	4	8	8	8	8	
33	4	8	2	4	8	2	4	8	2	4	8	2	Student talk.
34	9	9	9	9	4	8	2	4	8	8	8	7	126÷503=25%
35	7	9	5	4	8	4	8	4	8	4	8	4	
36	8	4	8	4	8	4	9	4	4	8	4	8	Silence
37	4	8	8	3	3	5	9	4	8	9	8	8	9÷503=1.7%
38	4	8	4	8	4	8	4	8	2	4	8	8	
39	8	9	9	4	8	4	8	2	4	8	9	3	I/D 171÷197=.86
40	4	8	4	8	4	8	4	8	2	2	4	8	i/d 91÷32=2.84
41	8	8	7	7	4	4	8	3	4	8	2	3	
42	4	4	8	2	3	3	3	3	4	8	2	10	

OBSERVATION RECORD # 5

(Scientific Approach)

I-A — 2nd Week

Time Minutes	Categories													Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	6	
2	6	6	6	6	9	9	6	6	4	4	8	8	4	
3	2	8	3	3	3	5	5	5	5	5	5	5	5	
4	6	6	4	8	2	2	3	3	3	1	1	1	9	
5	1	3	4	8	2	3	4	4	8	8	2	2	3	
6	3	4	8	8	3	3	4	8	3	4	8	3	4	-Teacher questioned
7	8	3	4	8	3	4	4	8	8	2	2	3	3	students; students
8	5	5	5	5	5	5	5	5	5	5	5	5	5	answered questions.
9	4	4	8	8	5	5	5	5	5	5	5	5	5	Teacher accepts
10	4	4	8	8	2	2	2	4	4	8	8	3	5	answers & enlarged on
11	9	9	9	9	9	3	3	3	3	3	5	5	5	student ideas.
12	5	5	5	5	5	5	5	5	5	5	5	5	5	-Teacher lectured on
13	4	4	8	8	3	3	3	5	5	5	5	5	5	the steps of the
14	3	3	3	4	8	9	8	8	9	9	9	9	7	scientific method,
15	7	7	7	7	5	5	4	4	4	9	4	8	8	scientific data,
16	4	8	2	4	8	2	4	8	2	4	8	2	4	standard laboratory
17	8	2	6	6	6	6	6	10	10	4	8	8	5	equipment etc.
18	4	4	8	8	3	3	4	4	10	10	5	5	9	
19	4	4	4	8	8	4	8	5	8	4	8	8	4	
20	10	5	4	8	8	2	2	3	3	8	8	2	2	Teacher talk.
21	3	3	4	8	9	8	8	9	9	9	7	7	7	345÷503=68%
22	7	7	10	10	5	5	4	4	9	4	8	8	8	
23	4	8	2	8	8	2	8	8	8	8	3	3	6	Student talk.
24	4	8	2	4	4	8	8	3	3	3	3	4	4	148÷503=29%
25	8	8	3	3	4	4	8	8	3	3	4	8	3	
26	4	4	8	8	3	3	5	5	5	4	4	8	8	Silence
27	3	3	3	9	9	9	9	1	1	1	5	5	5	10÷503=1.9%
28	5	5	7	4	4	4	8	8	3	3	4	4	8	
29	8	5	5	5	5	4	8	8	3	3	4	4	8	I/D 210÷135=1.55
30	2	3	3	9	9	9	1	1	1	1	4	8	5	i/d 105÷35 =
31	3	4	8	8	3	4	8	8	3	3	4	8	8	
32	2	2	4	8	2	4	8	3	4	8	3	4	8	
33	2	1	1	1	5	5	4	4	8	2	3	3	3	
34	1	1	1	1	4	8	8	3	3	3	3	4	8	
35	4	8	8	4	8	8	4	8	8	4	8	8	4	
36	4	4	8	4	4	8	8	4	4	8	4	4	8	
37	4	4	8	1	1	4	4	8	8	4	8	4	8	
38	4	8	4	8	8	3	3	4	4	8	8	4	4	
39	8	8	4	4	8	3	3	4	8	8	4	8	8	
40	8	5	5	5	5	5	5	5	5	5	5	5	5	
41	5	5	5	5	5	5	5	4	8	8	8	8	8	
42	5	5	5	5	5	4	8	8	8	10	10	10	10	

OBSERVATION RECORD #6

(Scientific Approach)

I-B 2nd Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	4	4	8	8	5	5	
2	5	5	5	5	5	5	5	5	5	5	5	5	
3	4	4	8	8	5	5	5	5	5	5	5	5	
4	4	4	8	8	2	2	2	4	4	8	8	3	
5	5	5	5	5	5	5	5	5	5	5	5	5	
6	9	9	9	9	9	3	3	3	3	3	5	5	
7	5	5	5	5	5	5	5	5	5	5	5	5	
8	4	4	8	8	3	3	3	5	5	5	2	2	
9	5	5	4	4	8	8	8	3	3	4	4	8	
10	8	8	3	3	4	4	8	8	8	4	4	8	
11	8	8	3	3	4	4	10	10	5	4	8	8	Teacher talk.
12	4	4	8	8	4	8	5	8	4	8	8	4	370÷503-74%
13	10	5	4	8	8	2	2	3	3	8	8	2	
14	2	3	3	4	8	9	8	8	9	9	9	7	
15	7	7	7	7	5	5	4	4	4	9	4	8	Student talk.
16	8	8	8	4	8	8	8	8	4	8	2	8	127÷503=25%
17	8	3	3	4	8	4	8	4	4	8	8	3	
18	3	3	3	4	4	8	8	3	3	4	4	8	Silence.
19	8	3	3	4	8	3	4	4	8	8	3	3	6÷503=1.1
20	5	5	5	4	4	8	8	3	3	3	9	9	
21	9	9	1	1	1	1	5	5	5	5	5	7	
22	7	4	4	4	8	8	3	3	4	4	8	8	I/D 227÷143=1.58
23	10	5	5	4	4	4	8	8	3	3	4	4	i/d 107÷23=4.65
24	8	8	3	4	4	4	8	8	8	3	3	4	
25	4	8	8	3	3	9	9	9	1	1	1	1	
26	5	5	4	4	8	8	3	3	4	4	4	8	
27	9	9	1	1	1	1	5	5	4	8	4	8	
28	3	3	5	5	5	5	5	5	5	4	4	8	
29	3	3	2	2	1	1	5	5	4	4	8	3	
30	3	4	8	1	1	1	1	4	4	2	2	2	
31	2	2	2	2	2	5	5	5	4	8	4	5	
32	5	5	5	5	5	5	5	5	5	5	6	10	
33	6	6	6	4	4	8	8	4	8	4	8	3	
34	3	3	4	8	8	3	3	2	2	2	5	5	
35	5	4	8	8	4	10	4	4	8	8	4	4	
36	8	8	3	3	4	8	2	4	4	8	4	4	
37	4	8	3	3	4	8	4	8	8	4	4	8	
38	3	4	8	3	4	8	3	8	2	2	4	8	
39	4	4	8	8	3	4	4	1	1	1	1	4	
40	4	5	4	4	8	4	5	4	4	5	4	4	
41	5	5	5	5	5	5	5	5	5	5	5	5	
42	6	6	6	6	6	6	5	5	5	5	5	10	

OBSERVATION RECORD #7

(Scientific Approach)

D-A 2nd Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	6	6	6	10	6	4	8	5	5	5	5	5	
3	5	5	5	5	5	5	5	5	5	5	5	5	
4	4	4	8	5	5	3	5	5	5	5	5	5	
5	5	5	5	5	5	5	5	5	5	5	5	5	
6	5	5	5	4	8	5	5	4	4	8	5	5	
7	5	5	5	5	5	5	5	5	5	5	5	5	
8	5	5	5	5	5	5	5	5	5	5	5	5	
9	7	5	5	5	5	5	5	4	4	8	5	5	
10	4	8	5	3	3	5	5	7	7	7	7	7	
11	7	7	5	5	5	5	5	5	5	5	5	5	
12	5	5	5	5	5	5	5	5	5	5	5	5	
13	5	5	5	5	5	5	4	4	8	5	5	5	
14	5	5	5	5	5	5	5	4	8	5	5	4	Student relating
15	3	3	3	5	5	5	5	5	4	8	5	5	experience.
16	8	5	5	5	5	5	5	5	4	8	5	5	
17	5	5	4	8	8	8	9	9	9	5	5	5	Student needed some-
18	9	5	5	4	8	9	5	5	5	5	5	5	thing clarified.
19	5	5	5	5	5	5	5	5	5	5	5	5	
20	5	5	5	5	5	5	5	5	5	5	5	5	
21	5	5	5	5	5	5	5	5	5	5	5	5	
22	5	5	7	4	8	5	5	5	5	5	4	8	
23	8	4	8	4	8	8	8	7	8	8	8	3	
24	6	5	5	5	5	5	5	5	5	5	5	5	
25	5	5	5	9	9	9	9	5	1	1	1	5	
26	5	5	5	5	5	5	4	8	8	3	5	5	
27	5	5	5	5	4	4	8	8	4	4	8	8	
28	5	5	5	5	5	5	5	4	8	3	9	3	
29	4	8	3	5	4	8	8	8	8	5	5	5	I/D 102÷303=.336
30	5	5	5	4	8	5	5	5	5	5	5	5	i/d 24÷25=.96
31	5	5	5	4	4	8	8	4	8	3	3	5	
32	5	6	4	4	8	8	8	3	4	4	4	4	
33	8	8	3	3	5	4	4	4	4	10	4	4	Teacher talk.
34	4	10	4	10	5	5	5	5	4	4	4	4	405÷503=80%
35	4	4	4	4	8	8	8	3	5	5	5	5	
36	4	4	8	8	4	4	4	10	10	10	10	10	Student talk.
37	4	4	4	4	4	4	8	8	8	8	3	3	85÷503=17%
38	5	5	4	4	4	4	4	4	4	4	4	8	
39	8	8	8	8	8	4	8	8	8	4	4	8	
40	8	8	8	8	5	5	5	5	4	8	8	8	Silence.
41	3	5	5	4	8	8	5	5	5	5	5	5	20÷502=2.5%
42	9	9	5	5	5	5	5	7	5	5	5	10	

OBSERVATION RECORD #8

(Scientific Method)

D-B 2nd Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	5	5	5	5	
2	6	6	6	6	6	5	5	5	5	5	5	5	
3	5	6	6	6	4	4	8	5	5	5	5	5	
4	4	4	4	4	4	4	5	5	5	5	5	4	
5	8	4	4	4	10	10	4	4	5	5	5	5	
6	4	5	5	5	5	5	5	5	5	7	10	5	
7	5	5	5	5	5	5	4	4	4	4	8	8	
8	3	4	5	5	5	5	5	5	4	8	5	5	
9	5	5	5	5	5	5	5	5	5	5	5	5	
10	5	9	4	8	3	4	4	8	2	1	5	5	
11	5	5	5	5	5	5	5	5	5	5	5	5	
12	5	5	5	5	4	8	4	8	8	5	5	5	
13	9	9	5	9	5	5	5	5	5	5	5	5	
14	5	5	5	5	5	5	5	5	5	5	5	5	
15	5	5	5	5	5	3	2	2	2	2	2	5	
16	5	5	4	8	4	8	4	8	9	9	1	1	
17	1	1	5	5	5	5	5	5	5	5	5	5	
18	4	4	4	4	7	10	4	10	7	4	4	5	
19	4	5	4	5	4	4	8	4	8	8	4	8	
20	5	5	5	5	5	5	4	4	6	6	4	8	
21	3	3	4	4	4	8	8	3	3	5	5	5	Teacher talk.
22	4	4	8	8	8	5	5	5	5	5	5	5	413÷503=82%
23	9	9	3	3	9	5	5	5	5	5	5	5	
24	4	4	8	8	4	8	3	3	2	1	1	6	
25	4	4	4	4	8	3	4	4	8	8	3	5	Student talk.
26	4	10	10	10	5	5	5	4	4	4	4	4	70÷503=14%
27	9	4	4	4	8	8	8	4	4	4	8	3	
28	1	1	1	1	4	4	8	8	8	3	3	5	
29	3	5	5	5	5	5	5	5	5	5	9	9	Silence.
30	5	4	8	8	8	8	5	5	5	5	5	9	20÷503=1.9%
31	5	10	5	5	5	9	9	5	5	4	6	6	
32	10	10	10	10	10	7	7	7	7	9	9	2	
33	3	5	5	5	5	5	5	5	5	5	5	5	I/D 127÷286=.444
34	5	5	5	5	5	10	5	5	5	5	5	5	i/d 47÷26=1.80
35	5	5	5	4	8	2	2	10	10	10	10	4	
36	8	8	3	3	8	8	5	5	5	5	5	5	
37	5	5	5	5	5	5	2	2	5	5	5	5	
38	5	5	5	3	3	3	4	5	5	5	5	5	
39	5	5	5	5	5	5	5	5	5	5	5	5	
40	7	9	5	8	8	4	8	8	4	8	4	8	
41	3	3	4	8	4	8	8	3	3	9	9	10	
42													

OBSERVATION RECORD #9

(The Microscope)

I-A

3rd Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	5	2	4	6	6	4	8	8	4	8	8	4	
3	2	5	5	5	5	5	5	5	5	5	5	5	
4	5	5	5	5	5	5	5	5	5	5	5	5	
5	4	10	10	10	4	6	10	2	5	8	8	5	Lecture on method and care of the microscope.
6	1	1	1	5	5	4	4	4	8	8	8	9	
7	5	5	5	4	4	4	4	8	8	4	4	4	
8	8	3	3	3	5	4	4	8	8	8	3	3	
9	4	4	8	8	8	3	3	4	4	8	9	3	1. Techniques in slides.
10	3	3	5	5	5	2	2	5	4	4	4	8	
11	8	8	8	3	3	3	4	4	8	8	8	3	2. Observation and diagrams
12	3	3	4	4	8	8	4	4	4	8	8	3	
13	3	3	4	4	10	10	5	5	2	2	4	4	3. Value as an instrument of discovery.
14	8	8	4	8	5	8	3	3	8	8	8	8	
15	8	4	9	9	4	4	4	4	8	4	8	8	
16	7	7	7	9	9	9	9	10	9	9	9	9	
17	10	9	9	9	9	10	9	9	9	9	9	9	
18	2	2	2	9	9	9	9	3	3	3	3	3	
19	5	4	4	4	8	9	3	3	3	5	5	5	
20	2	2	5	4	4	4	8	8	9	3	3	3	
21	4	4	8	8	8	3	3	3	4	4	4	8	
22	8	4	4	8	8	8	3	3	4	4	10	10	Teacher talk.
23	5	5	2	2	4	4	8	4	8	5	8	8	343÷503=68%
24	8	8	6	10	6	6	6	6	6	6	6	6	
25	2	4	6	4	4	8	8	4	8	9	4	8	
26	2	5	5	5	5	5	5	5	5	5	5	5	Student talk.
27	5	5	5	5	5	5	5	5	5	5	5	5	140÷503=28%
28	4	10	10	4	4	6	8	2	5	8	8	5	
29	1	1	1	5	5	4	4	4	8	8	8	8	Silence.
30	5	5	5	5	5	5	5	8	4	4	4	4	20÷50=3.9%
31	3	4	4	8	10	9	9	9	9	1	1	1	
32	1	1	4	4	4	8	3	3	9	9	1	1	
33	1	4	4	8	9	3	3	10	4	8	8	3	I/D 218÷125=1.74
34	3	3	3	4	4	8	8	3	3	4	4	8	i/d 107÷30=3.56
35	8	3	9	9	9	9	1	1	1	1	5	5	
36	5	5	5	7	7	4	4	4	4	8	8	3	
37	3	4	4	8	8	10	8	3	3	4	4	8	
38	3	3	4	4	8	8	3	3	4	4	8	8	
39	3	3	9	9	9	1	1	1	1	5	4	4	
40	4	8	8	3	3	4	4	4	10	9	9	1	
41	1	1	1	5	4	4	4	8	8	3	3	2	
42	2	2	2	1	1	1	2	1	1	9	1	10	

OBSERVATION RECORD #10

I-B (The Microscope) 3rd Weed

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	5	
2	5	5	5	5	5	5	5	5	5	5	5	5	
3	1	1	1	5	5	4	4	4	8	8	8	8	
4	5	5	5	5	4	4	4	8	8	4	4	4	
5	3	4	4	8	8	9	9	9	9	1	1	1	
6	1	1	4	10	4	8	3	3	9	9	1	1	
7	1	4	4	8	8	3	3	10	4	8	8	3	
8	3	3	3	4	4	8	8	3	3	4	4	8	
9	8	3	9	9	9	9	1	1	1	5	5	5	
10	5	5	5	7	5	4	4	4	4	8	8	3	
11	3	4	4	8	8	10	8	3	3	4	4	8	
12	3	3	4	4	8	8	3	3	4	4	8	8	
13	3	3	9	9	9	1	1	1	1	5	5	5	
14	4	8	8	3	3	4	4	10	8	9	9	1	
15	1	1	1	5	4	4	4	8	8	3	3	2	
16	2	2	2	1	1	1	2	1	1	9	1	1	
17	6	6	6	6	6	6	6	6	6	6	6	6	
18	5	2	4	6	6	6	6	4	4	8	8	4	
19	8	8	4	1	1	1	5	5	5	4	4	8	
20	8	9	9	9	9	4	4	4	8	4	8	8	
21	8	7	7	9	9	9	9	10	9	9	9	9	-Three students expresse
22	10	9	9	9	9	9	10	9	9	9	9	9	their views.
23	2	2	2	9	9	9	3	3	3	3	3	3	
24	1	1	1	5	5	4	4	4	8	8	8	3	
25	3	3	3	4	4	8	8	8	3	3	3	4	
26	4	8	8	8	4	4	8	8	8	3	3	4	
27	4	10	8	8	6	10	6	6	6	6	6	6	Teacher talk.
28	2	4	6	4	4	8	8	4	8	8	4	8	348÷503=69%
29	2	5	5	5	5	5	5	5	5	5	5	5	
30	4	10	10	4	4	6	8	2	5	8	8	5	
31	1	1	1	5	5	4	4	4	8	8	8	8	Student talk.
32	5	5	5	5	4	4	4	4	8	8	4	4	141÷503=28%
33	3	4	4	8	8	9	9	9	9	1	1	1	
34	1	1	4	10	4	8	3	3	9	9	1	1	Silence
35	1	4	4	8	8	3	3	10	4	8	8	8	14÷503=2.7%
36	3	3	3	3	4	4	8	8	3	3	4	4	
37	8	8	3	9	9	9	4	8	5	5	3	5	
38	5	5	5	7	7	4	4	4	4	5	5	3	I/D 221÷127=1.74
39	3	4	4	5	5	10	5	3	3	5	4	8	i/d 126÷45=2.8
40	3	3	4	4	5	5	3	3	5	5	8	8	
41	3	3	9	9	4	5	2	2	2	5	3	4	
42	4	5	5	3	3	4	4	10	5	9	9	10	

OBSERVATION RECORD # 11

(The Microscope)

D-A

3rd Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	6	6	6	6	6	6	6	6	6	6	6	6	
3	9	9	9	5	5	5	5	5	5	5	5	5	
4	4	4	8	8	8	3	3	5	5	5	3	5	
5	5	5	5	5	5	5	5	5	5	3	3	9	
6	4	4	8	8	8	4	4	8	3	3	3	5	
7	5	5	5	5	5	5	5	5	5	5	5	5	
8	5	5	5	5	5	5	5	5	5	5	5	5	
9	7	5	5	5	5	5	5	4	4	8	8	8	
10	4	8	8	3	3	3	5	7	7	7	7	7	
11	6	6	6	6	6	6	6	6	6	6	6	6	
12	9	9	9	9	9	3	3	3	3	5	5	5	
13	5	5	5	5	5	5	5	5	5	5	5	5	
14	4	4	8	8	8	2	2	3	3	6	6	6	
15	6	9	9	9	7	7	3	3	4	10	10	10	
16	10	6	6	6	9	9	4	8	7	7	5	5	
17	5	4	4	8	8	3	3	5	5	5	5	3	
18	5	5	5	5	5	5	5	5	5	5	3	3	
19	4	4	4	8	8	8	4	4	8	3	3	5	
20	5	5	5	5	5	5	5	5	5	5	5	5	
21	5	5	5	5	5	5	5	5	5	5	5	5	Teacher talk.
22	7	5	5	5	5	5	5	5	5	4	4	8	410÷503=82%
23	4	8	8	3	3	3	5	7	7	7	7	7	
24	5	5	5	5	5	5	5	5	5	5	5	5	
25	7	5	5	5	5	5	5	5	5	5	5	5	Student talk.
26	5	5	5	5	5	5	5	5	6	4	8	8	82÷503=16%
27	5	5	5	5	5	5	5	5	4	8	8	8	
28	3	3	3	5	5	5	5	5	9	8	8	8	
29	8	5	5	5	5	5	9	9	9	5	5	5	
30	5	5	9	9	9	5	9	9	9	5	5	5	Silence.
31	9	5	5	8	8	8	5	5	5	5	5	5	11÷503=2.1%
32	5	5	5	5	5	5	5	5	5	5	5	5	
33	5	5	5	5	5	5	5	5	5	5	5	5	
34	4	4	8	8	4	8	3	3	5	5	6	4	I/D 100÷310=.322
35	4	4	8	3	4	4	4	4	8	8	3	3	i/d 41÷63=.650
36	5	4	4	4	10	10	4	4	10	4	10	5	
37	5	4	4	4	4	4	4	8	8	8	5	5	
38	4	4	4	8	8	8	4	8	4	4	8	8	
39	5	5	5	4	8	8	5	5	5	5	5	5	
40	9	9	5	5	5	5	7	5	5	4	10	5	
41	4	4	8	8	8	3	3	5	5	5	6	5	
42	4	4	8	8	8	3	3	5	5	5	3	10	

OBSERVATION RECORD #12

(The Microscope)

D-B

3rd Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	8	8	8	8	8	8	8	8	
2	8	8	8	8	2	8	8	8	8	8	8	8	
3	8	8	8	8	8	6	8	8	8	8	8	8	Student read from textbook.
4	5	5	5	5	5	5	5	5	5	5	5	5	
5	5	5	5	5	5	5	5	5	5	5	5	5	
6	5	5	4	4	6	6	8	8	8	8	8	8	
7	8	8	8	8	8	8	8	8	8	3	3	3	
8	5	5	5	5	5	5	5	5	5	4	4	5	
9	4	4	8	8	8	5	5	5	5	4	4	5	Teacher demonstrated how to use a micro-scope.
10	5	5	5	5	5	5	5	5	5	5	5	5	
11	6	6	8	8	8	8	8	3	3	3	5	5	
12	5	5	6	6	8	8	8	8	8	8	8	8	
13	8	8	8	8	8	8	8	8	8	8	8	8	Student read from textbook.
14	8	4	8	8	4	8	9	5	5	5	5	5	
15	9	9	9	9	9	9	10	9	9	9	9	9	
16	9	9	9	9	9	9	9	10	9	9	9	9	
17	1	1	1	1	5	5	4	5	9	9	9	9	10 indicates different students speaking.
18	9	9	2	2	2	2	3	3	5	5	5	5	
19	6	6	6	6	6	5	5	5	5	5	5	5	
20	10	10	10	5	5	5	5	5	5	9	9	3	
21	5	5	4	4	8	3	4	8	3	4	8	8	
22	3	5	4	5	4	4	5	5	6	6	6	6	
23	6	5	5	4	5	4	4	10	4	4	8	8	
24	3	3	4	8	3	5	4	4	4	8	3	3	
25	4	8	3	3	4	8	4	8	4	9	9	9	
26	9	1	1	2	2	2	6	6	6	6	6	6	
27	4	2	2	3	3	3	10	10	5	4	8	8	Teacher talk.
28	4	4	8	8	3	5	5	5	5	5	4	4	340÷503=68%
29	8	5	5	5	5	5	5	5	5	5	4	4	
30	6	6	6	6	6	6	6	6	6	6	6	6	Student talk.
31	6	6	6	6	6	6	6	6	6	6	6	6	153÷503=309%
32	9	9	9	1	1	1	5	5	5	5	5	5	
33	4	4	8	8	8	3	3	5	5	5	5	5	
35	5	5	5	5	5	5	5	5	6	3	3	3	Silence
36	9	4	4	8	8	8	4	4	8	3	3	4	10÷503=1.9%
37	4	4	8	8	8	8	8	4	4	6	3	3	
38	6	8	8	3	3	5	7	7	7	7	7	7	
39	5	6	6	6	6	6	6	6	6	6	6	6	I/D 111÷229=.484
40	9	9	9	9	9	3	3	3	3	6	6	5	i/d 60÷71=.845
41	6	9	9	9	9	3	3	3	6	6	5	5	
42	9	6	5	5	6	6	5	5	3	3	9	10	

OBSERVATION RECORD #13

(Recognition of Living Things)

I-A — 4th Week

Time Minutes	Categories												Comment on Lesson
1	10	5	5	5	5	5	5	5	5	5	5	5	
2	5	5	5	6	6	4	4	8	5	5	5	5	
3	5	5	5	5	5	5	9	9	4	4	4	4	
4	4	4	8	8	4	4	5	5	5	5	5	5	
5	4	4	8	8	2	2	2	4	4	8	8	3	
6	5	5	5	5	5	5	5	5	4	4	4	4	
7	9	9	9	9	9	3	9	9	4	4	5	5	Recognition of Living Things
8	4	4	8	8	2	2	2	4	4	8	8	3	
9	4	4	8	8	3	3	3	5	5	2	9	9	
10	4	8	2	3	4	8	8	3	3	4	4	8	1. Characteristics of living things.
11	8	8	4	4	8	5	5	3	3	4	4	10	
12	10	5	5	2	2	4	4	8	8	4	8	5	2. Comparison of living things.
13	8	4	8	8	4	10	5	4	8	8	3	3	
14	2	2	8	8	2	2	3	3	4	8	9	8	3. Form.
15	8	9	8	8	7	7	7	7	7	5	5	9	4. Movement.
16	4	4	4	9	4	8	8	3	8	8	8	4	5. Structure.
17	4	8	8	8	8	4	8	2	8	8	3	3	6. Size.
18	6	6	5	5	4	4	8	8	3	3	4	4	7. Chemical.
19	9	4	8	8	3	3	4	4	8	8	3	3	
20	4	8	3	4	4	8	5	3	3	5	5	4	
21	4	9	8	5	3	3	3	9	9	9	9	1	
22	1	1	1	1	5	5	5	5	4	5	7	4	Teacher talk.
23	4	4	4	8	8	3	3	4	4	8	8	10	372÷503=74%
24	5	5	5	4	4	8	8	3	3	4	4	8	
25	10	5	5	5	4	4	8	8	3	3	4	4	
26	8	8	3	3	4	4	8	8	8	3	3	4	Student talk.
27	4	8	8	3	3	9	8	8	1	1	1	1	121÷503=24%
28	5	5	4	4	8	8	3	3	4	4	10	8	
29	9	9	1	1	1	1	9	2	2	5	2	2	
30	2	2	2	2	5	5	4	4	8	4	5	4	Silence.
31	4	8	2	3	3	3	1	1	5	5	4	4	11÷503=2.1%
32	8	3	3	2	2	9	1	1	1	9	2	2	
33	9	2	2	2	2	2	5	5	5	4	8	9	
34	5	5	5	5	5	5	5	10	6	10	6	6	I/D 254÷118=2.15
35	4	4	8	8	4	8	4	8	3	3	2	2	i/d 134÷18=7.44
36	4	4	8	3	3	3	2	1	1	1	9	1	
37	2	2	8	2	2	2	2	5	5	4	8	4	
38	5	5	5	5	5	4	4	4	4	6	6	6	
39	9	9	7	6	4	4	8	4	4	5	3	3	
40	2	1	5	5	9	5	2	2	8	2	2	2	

OBSERVATION RECORD # 14

(Recognition of Living Things)

I-B

4th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	4	4	8	8	
2	4	8	8	4	8	2	2	2	2	5	5	5	
3	5	5	5	5	4	4	8	8	4	10	10	8	
4	8	5	5	5	5	5	4	4	8	8	4	8	
5	8	8	3	3	5	5	5	4	4	8	8	3	
6	3	3	9	9	9	9	1	1	1	1	5	5	
7	5	5	5	7	7	4	9	9	8	8	3	3	
8	4	4	8	8	10	5	5	5	4	4	8	9	
9	3	3	4	4	8	8	3	3	4	4	8	9	
10	8	3	3	4	4	8	8	3	3	9	9	9	
11	1	1	1	1	5	5	4	4	8	9	3	3	
12	4	4	10	8	9	9	1	1	1	1	5	5	
13	3	3	4	4	8	8	8	4	4	8	8	8	
14	3	3	4	4	10	10	5	5	2	2	4	4	
15	8	8	4	8	5	8	4	8	8	4	10	5	
16	5	8	8	3	4	2	2	8	8	2	2	3	
17	3	4	8	9	8	8	9	9	9	7	7	7	
18	3	4	9	8	8	3	3	4	8	3	3	9	
19	8	8	3	3	5	5	5	4	4	8	8	3	
20	3	3	9	9	6	6	1	1	1	1	5	5	Teacher talk.
21	5	5	5	7	7	4	4	4	8	8	3	3	361÷503=72%
22	4	4	8	8	7	5	5	5	4	4	8	8	
23	3	4	4	4	8	7	3	3	4	4	8	8	
24	8	4	3	4	4	8	8	3	3	9	9	9	Student Talk.
25	1	1	1	1	5	5	4	4	8	8	3	3	132÷503=26%
26	4	4	7	8	9	1	1	1	1	1	5	5	
27	4	8	4	8	3	9	5	5	5	5	5	5	Silence
28	5	4	4	8	3	9	2	2	1	1	1	5	10÷503=1.9%
29	5	4	4	8	3	3	2	9	1	1	1	1	
30	9	2	2	9	2	2	2	2	2	5	5	5	
31	4	8	4	5	5	5	5	5	5	5	5	5	I/D 232÷129=1.79
32	10	6	7	6	6	6	4	4	8	7	4	8	i/d 132÷39=3.38
33	4	8	3	3	4	7	7	3	3	2	2	2	
34	5	5	5	4	8	8	4	8	8	4	8	10	
35	4	4	8	8	3	3	4	8	3	4	8	3	
36	4	8	3	4	8	3	4	4	8	8	3	3	
37	2	2	4	4	8	3	3	7	2	1	1	1	
38	2	2	4	4	8	3	3	3	2	1	1	1	
39	1	9	1	2	2	9	2	2	2	5	5	5	
40	4	8	4	2	2	2	5	5	5	5	5	5	
41	1	9	1	2	2	9	2	4	4	4	5	5	
42	6	6	6	6	9	9	6	6	4	4	8	10	

OBSERVATION RECORD # 15

(Recognition of Living Things)

D-A — 4th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	5	5	5	5	5	5	5	5	5	5	9	3	
3	4	4	8	8	3	3	4	4	8	2	2	2	
4	6	6	6	6	6	6	6	6	6	6	6	6	
5	5	5	5	5	5	5	5	5	5	5	5	5	
6	3	3	3	4	5	5	5	5	5	5	5	5	
7	5	5	5	5	5	5	5	5	5	5	5	5	
8	5	5	5	5	5	5	9	5	5	5	5	5	
9	5	5	5	5	5	5	5	5	5	5	5	5	
10	4	6	6	6	10	10	10	7	7	7	7	7	
11	9	9	4	8	2	2	3	5	5	5	5	5	
12	5	2	2	5	5	5	5	5	5	5	5	5	
13	3	3	3	4	5	5	5	5	5	5	5	5	
14	5	5	4	6	6	6	6	6	6	6	10	7	
15	7	7	7	7	9	9	4	3	2	2	5	5	
16	5	5	5	5	5	5	5	5	5	5	10	5	
17	5	5	4	8	2	2	2	4	8	2	5	8	
18	8	5	5	5	5	5	5	5	5	5	4	8	
19	8	2	2	4	5	5	5	5	5	5	5	5	
20	3	3	3	4	5	5	5	5	5	5	4	4	Teacher talk.
21	6	6	6	6	6	6	6	6	6	6	6	6	407÷503=81%
22	4	8	8	4	8	8	4	8	8	8	8	8	
23	4	8	5	8	4	8	8	8	8	8	8	4	
24	9	9	9	9	4	8	8	4	8	4	8	5	Student talk.
25	5	4	8	8	4	8	8	4	8	8	8	8	88÷503=17%
26	4	9	8	5	5	5	5	5	8	4	4	8	
27	4	8	5	8	4	4	8	2	2	3	3	8	
28	8	4	8	8	4	9	4	4	8	4	8	8	I/D 112÷295=.379
29	4	8	2	9	5	5	9	4	8	9	1	1	i/d 56÷95=.589
30	1	1	1	5	5	5	5	5	5	5	5	5	
31	6	6	6	6	6	6	6	6	6	6	6	6	
32	5	8	8	2	3	3	5	7	7	7	7	7	
33	7	5	5	5	5	5	5	5	5	5	5	5	
34	7	5	5	5	5	5	5	5	5	5	5	5	
35	6	6	6	6	6	6	6	6	6	6	6	6	
36	4	4	8	8	3	3	4	8	2	3	4	4	
37	8	8	3	3	5	5	4	4	4	4	4	4	
38	3	3	3	3	3	5	5	4	8	8	5	5	
39	5	5	5	5	9	9	5	5	5	7	5	5	
40	3	5	5	4	3	3	5	5	5	5	5	5	
41	9	9	1	1	1	1	1	7	5	5	5	10	
42	6	6	6	6	6	7	7	7	9	9	9	10	

OBSERVATION RECORD #16

(Recognition of Living Things)

D-B — 4th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	4	4	
2	6	6	6	6	6	6	6	6	6	6	6	6	
3	8	8	8	8	8	6	8	8	8	8	8	8	
4	5	5	5	5	5	5	5	5	5	5	5	5	
5	5	5	5	5	5	5	5	5	5	5	5	5	
6	5	5	5	5	6	4	8	8	8	8	4	4	
7	6	6	6	6	5	5	5	5	5	5	5	5	
8	10	10	10	5	5	5	5	5	5	3	3	3	
9	5	5	5	4	8	3	4	8	3	4	8	8	
10	3	5	5	5	5	5	5	5	5	5	5	5	
11	5	5	5	4	5	4	4	5	4	4	8	8	
12	3	3	4	8	3	5	5	4	4	8	3	3	
13	4	8	3	3	4	8	4	8	4	5	9	9	
14	9	2	2	2	3	3	6	6	6	6	5	5	
15	4	2	2	3	3	5	3	5	4	8	8	8	
16	4	4	8	8	3	5	5	5	5	5	4	4	
17	8	5	5	5	5	5	5	5	5	5	5	5	
18	6	6	6	6	6	6	6	6	6	6	6	6	
19	6	6	6	6	6	6	6	6	6	6	6	6	
20	9	9	9	5	5	5	5	5	5	5	5	5	
21	4	4	8	8	3	3	5	5	5	5	5	5	
22	4	4	8	8	3	3	5	5	5	5	5	3	
23	5	5	5	5	5	5	5	5	5	5	5	5	
24	9	4	4	8	8	8	4	4	8	3	3	4	
25	4	4	8	8	8	4	4	4	4	8	3	4	
26	4	8	8	3	3	5	7	7	7	7	7	7	
27	5	6	6	6	6	6	6	6	6	6	6	6	
28	9	9	9	9	9	3	3	3	3	3	5	5	Teacher talk
29	6	9	9	9	9	3	3	3	5	5	5	5	403÷503=80%
30	4	8	8	4	8	9	5	5	5	5	5	5	
31	9	2	2	2	3	5	6	6	6	6	4	4	
32	4	2	2	3	3	5	5	4	8	4	4	8	Student Talk.
33	6	6	6	6	6	6	6	6	6	6	6	6	95÷503=19%
34	4	4	8	8	8	3	3	5	5	5	5	5	
35	5	5	5	5	5	5	5	5	5	5	5	5	
36	9	4	4	8	4	8	4	4	9	1	1	1	Silence
37	4	8	8	3	3	5	7	7	7	5	5	6	5÷503=.99%
38	6	6	6	6	6	6	6	6	6	6	6	6	
39	9	9	9	9	3	3	3	3	5	3	5	5	I/D 130÷273=.476
40	6	9	9	9	1	1	1	2	3	3	4	4	i/d 70÷104=.673
41	5	5	5	5	5	5	5	5	5	5	5	5	
42	7	5	5	5	6	9	9	9	3	3	5	10	

OBSERVATION RECORD #16

(Recognition of Living Things)

D-B 4th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	4	4	
2	6	6	6	6	6	6	6	6	6	6	6	6	
3	8	8	8	8	8	6	8	8	8	8	8	8	
4	5	5	5	5	5	5	5	5	5	5	5	5	
5	5	5	5	5	5	5	5	5	5	5	5	5	
6	5	5	5	5	6	4	8	8	8	8	4	4	
7	6	6	6	6	5	5	5	5	5	5	5	5	
8	10	10	10	5	5	5	5	5	5	3	3	3	
9	5	5	5	4	8	3	4	8	3	4	8	8	
10	3	5	5	5	5	5	5	5	5	5	5	5	
11	5	5	5	4	5	4	4	5	4	4	8	8	
12	3	3	4	8	3	5	5	4	4	8	3	3	
13	4	8	3	3	4	8	4	8	4	5	9	9	
14	9	2	2	2	3	3	6	6	6	6	5	5	
15	4	2	2	3	3	5	3	5	4	8	8	8	
16	4	4	8	8	3	5	5	5	5	5	4	4	
17	8	5	5	5	5	5	5	5	5	5	5	5	
18	6	6	6	6	6	6	6	6	6	6	6	6	
19	6	6	6	6	6	6	6	6	6	6	6	6	
20	9	9	9	5	5	5	5	5	5	5	5	5	
21	4	4	8	8	3	3	5	5	5	5	5	5	
22	4	4	8	8	3	3	5	5	5	5	5	3	
23	5	5	5	5	5	5	5	5	5	5	5	5	
24	9	4	4	8	8	8	4	4	8	3	3	4	
25	4	4	8	8	8	4	4	4	4	8	3	4	
26	4	8	8	3	3	5	7	7	7	7	7	7	
27	5	6	6	6	6	6	6	6	6	6	6	6	
28	9	9	9	9	9	3	3	3	3	3	5	5	Teacher talk
29	6	9	9	9	9	3	3	3	5	5	5	5	403÷503=80%
30	4	8	8	4	8	9	5	5	5	5	5	5	
31	9	2	2	2	3	5	6	6	6	6	4	4	
32	4	2	2	3	3	5	5	4	8	4	4	8	Student Talk.
33	6	6	6	6	6	6	6	6	6	6	6	6	95÷503=19%
34	4	4	8	8	8	3	3	5	5	5	5	5	
35	5	5	5	5	5	5	5	5	5	5	5	5	
36	9	4	4	8	4	8	4	4	9	1	1	1	Silence
37	4	8	8	3	3	5	7	7	7	5	5	6	5÷503=.99%
38	6	6	6	6	6	6	6	6	6	6	6	6	
39	9	9	9	9	3	3	3	3	5	3	5	5	I/D 130÷273=.476
40	6	9	9	9	1	1	1	2	3	3	4	4	i/d 70÷104=.673
41	5	5	5	5	5	5	5	5	5	5	5	5	
42	7	5	5	5	6	9	9	9	3	3	5	10	

OBSERVATION RECORD #17

Film Strip (Digestion)

I-A — 5th Week

Time Minutes	Categories											
1	10	6	6	6	6	6	6	6	6	6	6	6
2	10	10	6	6	6	6	6	6	6	6	6	6
3	5	2	4	6	6	4	8	8	4	8	8	4
4	2	5	5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5	5	5	5
6	4	4	8	8	2	2	2	4	4	8	8	3
7	9	9	9	9	9	9	3	3	3	3	5	5
8	4	4	8	8	3	3	3	5	5	9	2	2
9	4	4	8	8	2	2	2	4	4	8	8	3
10	5	5	5	5	5	5	5	5	5	5	5	5
11	9	9	9	9	9	3	3	3	3	3	5	3
12	4	4	8	8	3	3	5	5	5	2	2	2
13	5	5	4	4	8	8	8	3	3	4	4	8
14	8	8	3	3	4	4	8	8	8	4	4	8
15	8	8	3	3	4	4	10	10	5	5	2	2
16	1	1	1	5	5	5	4	4	8	8	8	8
17	4	4	8	8	2	2	2	2	3	3	3	3
18	5	5	5	5	4	8	2	4	8	2	5	5
19	5	5	5	9	9	9	9	10	9	9	9	9
20	10	9	9	9	9	9	10	9	9	9	9	9
21	2	2	2	9	9	9	9	3	3	3	3	3
22	5	5	4	4	8	8	3	3	3	5	5	5
23	2	2	5	5	4	4	8	8	8	3	3	3
24	4	4	8	8	2	2	2	2	4	4	8	8
25	8	4	4	8	8	8	3	3	4	4	10	10
26	5	5	2	2	4	4	8	8	4	8	5	8
27	8	8	8	6	6	6	6	6	6	6	6	6
28	2	4	6	6	4	8	8	4	8	8	4	8
29	1	1	1	5	5	5	4	4	8	8	8	8
30	5	5	5	5	5	5	4	4	8	8	4	4
31	1	1	1	5	5	5	4	4	8	8	8	8
32	3	4	4	8	8	9	9	9	9	1	1	1
33	1	1	4	10	4	8	3	3	9	9	1	1
34	1	4	4	8	8	3	3	4	8	8	8	3
35	3	3	3	4	4	8	8	3	3	4	4	8
36	8	3	9	9	9	9	1	1	1	1	5	5
37	5	5	5	7	7	7	4	4	4	8	8	3
38	3	4	4	4	8	8	3	3	4	4	8	8
39	4	4	9	9	1	1	1	5	5	5	4	4
40	8	8	4	4	4	4	8	8	9	9	1	1
41	1	1	5	5	5	4	4	4	8	2	2	2
42	2	4	8	4	8	4	4	4	8	4	8	10

Comment on Lesson

Teacher giving students directions for reviewing the film.

1. Phase of digestion.
2. Place of digestion.
3. Glands.
4. Secretion.
5. Enzymes.
6. Digestive Activity.

Teacher talk.
344÷503=71%

Student Talk.
140÷503=28%

Silence
8÷503=1.5%

I/D 210÷145=1.44
i/d 114÷55=2.61

OBSERVATION RECORD #18

Film Strip (Digestion)

I-B 5th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	5	2	4	6	6	4	8	8	4	8	8	4	
3	2	7	7	7	7	5	5	5	5	5	5	5	
4	5	5	5	5	5	5	5	5	5	5	5	5	
5	2	2	2	1	1	1	2	1	1	9	1	10	
6	1	1	1	5	5	4	4	8	8	3	3	2	
7	4	8	8	3	3	4	4	10	8	9	9	1	
8	3	3	9	9	9	1	1	1	1	5	5	4	
9	3	3	4	4	8	8	3	3	4	4	8	8	
10	3	4	4	8	8	10	8	3	3	4	4	8	
11	5	5	5	7	7	7	4	4	4	8	8	3	
12	8	3	9	9	9	9	1	1	1	1	5	5	
13	3	3	3	4	4	8	8	3	3	4	4	8	
14	1	4	4	8	8	3	3	10	4	8	8	3	
15	1	1	4	10	4	8	3	3	9	9	1	1	
16	3	4	4	8	8	9	9	9	9	1	1	1	
17	5	5	5	5	5	4	4	8	8	4	4	4	
18	1	1	1	5	5	5	4	4	8	8	8	8	
19	4	6	6	6	6	6	8	2	5	8	8	5	Teacher talk
20	5	5	5	5	5	5	5	5	5	5	5	5	352÷503=70%
21	4	4	8	2	2	3	3	5	5	5	5	5	
22	2	4	6	6	4	8	8	4	8	8	4	8	
23	8	8	8	6	6	6	6	6	6	6	6	6	Student talk.
24	5	5	2	2	4	4	8	8	4	8	5	8	141÷503=28%
25	8	4	4	8	8	8	3	3	4	4	8	8	
26	4	4	8	8	2	2	3	3	3	4	8	8	
27	2	2	5	5	4	4	8	8	8	3	3	3	Silence
28	5	5	4	4	8	8	3	3	3	5	5	5	10÷503=1.9%
29	2	2	2	9	9	9	9	3	3	3	3	3	
30	10	9	9	9	9	9	9	9	9	10	9	9	
31	9	9	9	9	7	7	8	8	4	8	8	4	I/D 216÷136=1.58
32	3	8	8	4	4	8	8	8	8	4	4	8	i/d 126÷54=2.33
33	3	3	4	8	8	3	3	2	2	2	2	5	
34	5	4	8	8	4	8	8	4	8	8	4	4	
35	8	8	3	3	4	8	3	2	2	2	4	4	
36	8	8	3	3	4	8	3	4	8	3	4	8	
37	8	8	3	3	4	8	3	4	8	3	4	8	
38	3	4	8	3	4	4	8	8	3	3	2	2	
39	4	4	8	3	3	3	2	2	2	3	3	9	
40	2	2	9	2	6	6	6	5	5	4	8	4	
41	6	6	6	6	6	6	6	6	6	6	6	6	
42	7	7	7	4	8	8	3	3	4	8	8	10	

OBSERVATION RECORD #19

Film Strip (Digestion)

D-B 5th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	4	4	8	8	4	4	8	8	4	8	6	6	
3	5	5	5	5	5	5	5	5	5	5	5	5	
4	5	5	5	5	5	5	5	5	5	5	5	5	
5	5	5	5	5	6	6	4	8	8	8	8	8	
6	6	6	6	6	6	5	5	5	5	5	5	5	
7	5	5	5	4	8	3	4	8	3	4	8	8	
8	3	5	5	5	5	5	5	5	5	5	5	5	
9	5	5	5	5	4	4	10	4	4	8	8	8	
10	3	3	4	8	3	5	5	4	4	8	3	3	
11	4	8	3	3	4	8	4	8	8	9	9	9	
12	9	2	2	2	3	3	6	6	6	6	6	6	
13	4	2	3	3	3	3	3	5	4	8	8	8	
14	4	4	8	8	3	5	5	5	5	5	4	4	
15	8	5	5	5	5	5	5	5	5	5	5	5	
16	6	6	6	6	6	6	6	6	6	6	6	6	Teacher talk.
17	6	6	6	6	6	6	6	6	6	6	6	6	410÷503=82%
18	9	9	5	5	5	5	5	5	5	5	5	5	
19	4	4	8	8	8	3	3	5	5	5	5	5	
20	4	4	8	8	3	3	5	5	5	5	5	5	Student talk.
21	5	5	5	5	5	5	5	5	5	5	5	5	83÷503=17%
22	9	4	4	8	8	8	4	4	8	3	3	4	
23	4	4	8	8	8	8	4	4	8	3	3	3	
24	4	8	8	3	3	5	7	7	7	7	7	7	Silence.
25	7	7	6	6	6	6	6	6	6	6	6	6	10÷503=1.9%
26	9	9	9	9	9	3	3	3	3	5	5	5	
27	6	9	9	9	9	3	3	3	5	5	5	5	
28	9	8	8	4	8	9	5	5	5	5	5	5	I/D 133÷277=.480
29	9	2	2	2	3	3	6	6	6	6	6	6	i/d 73÷120=.608
30	4	2	2	3	3	3	5	4	8	4	4	8	
31	6	6	6	6	6	6	6	6	6	6	6	6	
32	4	4	8	2	8	3	5	5	5	5	5	5	
33	5	5	5	5	5	5	5	5	5	5	5	5	
34	9	4	4	8	2	8	4	4	9	1	1	1	
35	4	8	8	3	3	5	7	7	7	5	6	6	
36	6	6	6	6	6	6	6	6	5	5	5	5	
37	9	9	9	9	3	3	3	3	5	3	5	5	
38	6	9	9	7	2	2	1	1	1	1	4	4	
39	5	5	5	5	5	5	5	5	5	5	5	5	
40	7	5	10	10	5	7	7	7	3	3	7	8	
41	10	10	10	4	5	4	4	10	4	4	7	7	
42	7	1	1	1	4	10	10	4	4	4	10	10	

OBSERVATION RECORD #20

(Film Strip (Digestion)

D-B

5th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	5	5	5	5	5	5	5	5	5	5	5	5	
3	4	4	8	8	3	3	3	4	8	8	3	3	
4	6	6	6	6	6	6	6	6	6	6	6	6	
5	5	2	2	5	5	5	5	5	5	5	5	5	
6	3	3	3	3	5	5	5	5	5	5	5	5	
7	5	5	5	5	5	5	5	5	5	5	5	5	
8	4	6	6	6	6	10	7	7	7	7	9	9	
9	9	9	3	3	2	5	5	5	5	5	5	5	
10	5	2	2	5	5	5	5	5	5	5	5	5	
11	3	3	3	4	5	5	5	5	5	5	5	5	
12	5	5	4	6	6	6	6	6	6	6	10	7	
13	7	7	7	7	9	9	9	3	3	2	5	5	
14	5	5	5	5	5	5	5	5	5	5	10	3	
15	5	5	5	8	2	2	4	6	8	2	5	8	
16	8	5	5	5	5	5	5	5	5	5	5	5	
17	5	2	2	5	5	5	5	5	5	5	5	5	
18	3	3	3	4	5	5	5	5	5	5	5	5	
19	6	6	6	6	6	6	6	6	6	6	6	6	
20	4	8	8	4	8	2	4	8	8	8	8	8	Teacher talk.
21	4	8	5	8	4	8	8	8	8	8	8	4	405÷503=81%
22	9	9	9	9	4	8	8	4	8	4	8	5	
23	6	6	6	6	6	6	6	6	6	6	6	6	
24	9	9	1	1	5	5	5	5	5	5	5	5	Student talk.
25	3	5	5	5	4	8	8	5	5	5	5	5	92÷503=18%
26	5	5	5	5	5	5	9	9	5	5	5	7	
27	5	5	4	4	8	8	2	3	4	4	8	8	Silence.
28	3	3	4	8	2	3	4	4	6	6	6	6	6÷503=1.1%
29	6	6	6	6	6	6	6	6	6	6	6	6	
30	7	5	5	5	5	5	5	5	5	5	5	5	
31	7	5	5	5	5	5	5	5	5	5	5	5	I/D 92÷313=.293
32	4	8	8	3	3	3	5	7	7	7	7	7	i/d 49÷103=.475
33	6	6	6	6	6	6	6	6	6	6	6	6	
34	5	5	5	5	5	5	5	5	5	5	5	5	
35	4	8	2	9	5	5	9	4	8	9	8	8	
36	8	4	8	8	4	9	4	8	3	4	4	8	
37	8	4	8	5	8	4	8	2	2	3	3	3	
38	8	4	9	8	5	5	5	5	5	5	5	5	
39	8	8	8	5	4	8	8	4	8	8	4	8	
40	9	9	9	10	4	8	8	8	8	8	8	8	
41	5	5	5	5	5	5	5	5	5	5	5	10	

OBSERVATION RECORD # 21

The Circulatory System

I-A

6th Week

Time Minutes	Categories											
1	10	6	6	6	6	6	6	6	6	6	6	6
2	4	4	4	4	4	4	4	4	4	4	4	4
3	4	4	4	4	10	9	9	9	9	10	4	4
4	4	4	8	8	2	2	4	8	2	9	9	3
5	3	3	3	3	3	4	4	1	5	5	5	5
6	4	4	9	1	1	1	1	1	9	9	9	9
7	1	1	1	4	8	2	4	8	2	4	8	2
8	6	6	6	6	6	6	6	6	6	6	6	6
9	4	4	8	8	2	2	4	4	8	8	2	2
10	4	6	6	6	6	10	7	7	7	7	9	9
11	9	9	3	3	2	5	5	5	5	5	5	5
12	5	2	2	5	5	5	5	5	5	5	5	5
13	3	3	3	4	5	5	5	5	5	5	5	5
14	9	3	3	4	10	5	5	5	5	5	5	5
15	5	5	4	6	6	6	6	6	6	6	6	7
16	7	7	7	7	9	9	9	3	3	2	5	5
17	4	4	4	4	4	4	4	4	4	4	4	4
18	3	3	3	4	5	5	5	5	5	5	5	5
19	6	6	6	6	6	6	6	6	6	6	6	6
20	9	9	3	3	2	5	5	5	5	5	5	5
21	3	3	3	4	5	5	5	5	5	5	5	5
22	4	8	8	4	8	8	4	8	8	8	8	8
23	4	8	5	8	4	8	8	8	8	8	8	4
24	9	9	9	9	4	8	8	4	8	4	8	5
25	1	1	1	5	5	5	4	4	4	4	8	8
26	4	4	8	8	2	2	2	2	3	3	3	3
27	2	2	3	3	3	5	5	5	1	1	1	5
28	5	5	4	4	8	8	8	8	4	4	8	8
29	4	4	1	1	1	5	5	4	4	4	8	8
30	3	3	4	8	2	3	4	4	6	6	6	6
31	8	3	4	4	4	4	1	1	1	1	5	5
32	7	5	5	5	5	5	5	5	5	5	5	5
33	7	4	4	4	4	4	4	4	4	4	4	4
34	4	8	8	3	3	3	5	7	7	7	7	4
35	3	3	4	4	1	1	1	5	5	5	4	4
36	4	8	2	9	9	1	1	1	1	1	1	1
37	3	3	4	1	4	8	8	3	3	4	4	8
38	4	4	8	8	2	2	2	4	4	8	8	3
39	4	4	8	8	2	2	3	3	5	5	9	2
40	3	3	9	5	1	1	1	5	5	5	4	4
41	8	8	3	3	4	4	10	8	4	4	1	5
42	5	5	5	5	5	5	4	8	2	2	3	10

Comment on Lesson

The Circulatory System

1. Composition of blood
2. Blood as a transporting medium
3. Blood transfusions
4. The Rh Factor in blood
5. The structure of the heart

Teacher talk
389 ÷ 503 = 77%

Student talk
109 ÷ 503 = 22%

Silence
5 ÷ 503 = 9%

I/D = 226 ÷ 163 = 1.38
i/d = 112 ÷ 63 = 1.77

OBSERVATION RECORD #22

The Circulatory System

I-B 6th Week

Time Minutes	Categories												Comment on Lesson
1	10	5	5	5	5	5	5	5	5	5	5	5	
2	6	6	6	6	6	4	4	8	8	5	5	5	
3	5	5	5	5	5	5	5	5	5	5	5	5	
4	4	8	3	3	2	2	2	5	5	4	8	2	
5	2	2	5	5	4	8	4	8	3	6	4	8	
6	2	1	1	1	1	9	1	2	2	9	2	2	
7	9	9	6	6	4	4	8	4	4	8	3	3	
8	5	5	5	5	5	5	5	5	6	6	6	6	
9	2	2	9	2	2	2	2	2	5	5	6	6	
10	2	2	9	2	2	2	2	5	5	4	8	4	
11	4	4	8	3	3	3	2	1	1	1	9	1	
12	4	4	8	8	4	8	4	8	3	3	2	2	Teacher talk.
13	5	5	5	5	5	5	5	10	6	10	6	6	364÷503=72%
14	9	2	2	2	2	2	5	5	5	4	8	4	
15	8	3	3	2	9	1	1	1	1	9	4	4	
16	5	5	4	4	8	8	3	3	4	4	10	8	
17	4	8	8	3	3	9	9	9	1	1	1	1	Student talk.
18	8	8	3	3	4	4	8	8	8	3	3	4	129÷503=26%
19	10	5	5	5	5	4	4	8	8	3	3	4	
20	4	5	5	5	4	4	4	8	3	3	3	4	
21	8	4	4	4	8	8	3	3	4	4	8	8	Silence.
22	1	1	1	1	5	5	5	5	5	5	5	5	10÷503=1.9%
23	9	9	9	9	9	4	4	4	4	4	5	5	
24	4	4	8	8	2	2	4	4	4	8	8	3	
25	4	8	2	3	4	8	8	3	3	4	4	8	
26	8	8	4	4	8	8	8	3	3	4	4	10	I/D 249÷115=2.16
27	10	5	5	2	2	4	4	8	8	4	8	5	i/d 150÷ 28=5.35
28	8	4	8	8	4	10	5	4	4	8	3	3	
29	2	2	8	8	2	2	3	3	4	8	9	8	
30	8	9	9	9	7	7	7	5	5	4	4	4	
31	9	4	4	8	3	8	8	8	4	4	8	8	
32	4	8	2	8	8	3	3	6	6	6	6	4	
33	4	4	4	8	3	3	4	8	3	4	4	8	
34	8	3	4	4	8	8	3	3	5	5	5	5	
35	4	4	8	8	3	3	3	9	9	9	1	1	
36	1	1	1	5	5	5	5	7	7	4	4	4	
37	8	8	3	3	4	4	8	10	5	5	5	5	
38	4	4	8	8	8	3	3	4	4	8	8	8	
39	3	3	4	4	8	8	3	3	4	4	8	8	
40	3	3	8	8	3	3	9	9	1	1	1	4	
41	9	2	2	9	2	2	9	2	2	2	2	2	
42	4	4	4	8	4	4	4	8	3	3	2	10	

OBSERVATION RECORD #23

The Circulatory System

D-A — 6th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	4	8	8	8	8	8	8	8	
2	6	6	6	6	6	6	6	6	6	6	6	6	
3	5	3	3	9	9	6	5	5	7	5	5	5	
4	5	5	5	5	5	6	9	1	1	1	1	1	
5	2	3	3	4	4	9	9	1	2	1	2	3	
6	3	4	4	9	9	9	9	2	2	1	2	3	
7	3	3	4	4	9	9	9	10	3	3	5	5	
8	3	5	6	6	6	6	6	6	6	6	6	6	
9	4	8	8	3	3	5	7	7	7	5	6	5	
10	4	4	8	2	2	4	4	8	1	1	1	5	
11	5	5	5	5	5	5	5	5	5	5	5	5	
12	4	4	8	2	2	4	4	8	1	1	1	1	
13	1	5	5	5	5	5	5	5	5	5	5	5	
14	4	4	8	8	8	3	3	3	5	5	5	5	
15	6	6	6	6	6	6	6	6	6	6	6	6	
16	4	8	2	3	3	5	7	7	7	7	7	7	Teacher talk.
17	4	4	8	2	4	8	7	5	5	5	5	5	408÷503=81%
18	5	6	6	6	6	6	6	6	6	6	6	6	
19	4	4	8	2	8	8	8	4	4	8	3	3	
20	5	4	4	8	2	8	4	4	8	2	3	4	Student talk.
21	5	5	5	5	5	5	5	5	5	5	5	5	83÷503=17%
22	4	4	8	8	3	3	5	5	5	5	5	3	
23	4	4	8	8	8	3	3	5	5	5	5	5	
24	7	7	7	10	10	10	5	5	5	5	5	5	Silence
25	6	6	6	6	6	6	6	6	6	6	6	6	12÷503=2.4%
26	6	6	6	6	6	6	6	6	6	6	6	6	
27	8	5	5	5	5	5	5	5	5	5	5	5	
28	4	4	8	8	3	5	5	5	5	5	4	4	I/D 136÷272=.5
29	4	2	2	3	3	3	3	5	4	8	8	8	i/d 75÷119=.630
30	5	6	6	6	3	3	6	6	6	6	6	6	
31	4	8	3	3	4	8	4	8	4	4	8	8	
32	3	3	4	8	3	5	5	4	4	8	3	3	
33	5	5	5	4	5	4	4	10	4	4	8	8	
34	3	5	5	5	5	5	5	5	5	5	5	5	
35	5	5	5	4	8	6	4	8	6	4	8	8	
36	10	10	10	5	5	5	5	5	5	5	5	5	
37	6	6	6	6	5	5	5	5	5	5	5	5	
38	8	8	8	4	8	8	8	8	4	8	8	8	
39	6	6	6	6	6	6	6	6	6	6	6	6	
40	5	5	5	5	5	5	5	6	6	6	4	4	
41	5	5	5	5	5	5	5	5	5	5	5	5	
42	4	8	8	8	8	8	5	5	5	5	5	10	

OBSERVATION RECORD #

The Circulatory System

D-B

6th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	6	6	6	6	6	6	6	6	6	6	6	6	
3	6	6	6	6	6	6	6	6	6	6	6	6	
4	9	9	6	6	6	6	6	6	6	7	5	5	
5	3	5	5	4	8	8	5	5	5	5	5	5	
6	5	5	5	5	9	9	9	9	5	5	7	5	
7	8	8	8	8	3	5	5	5	4	10	10	10	
8	8	8	3	3	5	5	3	3	4	4	4	4	
9	5	5	4	8	9	5	5	5	5	5	7	7	
10	7	7	7	6	6	6	6	6	6	6	6	9	
11	9	9	9	6	6	6	6	6	6	5	5	4	
12	6	6	6	6	6	6	10	6	6	6	9	9	
13	9	9	9	3	3	2	5	5	5	5	5	5	
14	5	5	5	5	10	6	5	5	5	8	2	2	
15	4	8	2	6	4	8	5	5	5	5	5	5	**Teacher talk.** 410÷503=82%
16	5	5	5	9	9	9	5	5	5	7	5	5	
17	8	8	8	8	3	5	5	4	8	8	5	5	
18	8	8	3	3	5	5	4	4	8	8	4	4	
19	8	8	4	8	3	3	4	8	2	3	4	4	Student talk. 83÷503=17%
20	6	6	6	6	6	6	6	6	6	6	6	10	
21	5	5	5	5	5	5	5	5	5	5	5	5	
22	5	5	5	5	5	5	5	5	5	5	5	5	
23	4	8	8	3	3	3	5	7	7	7	7	7	Silence 10÷503=1.9%
24	7	7	7	7	7	7	6	6	6	6	6	6	
25	6	6	6	6	6	6	6	6	6	6	6	6	
26	5	5	5	5	5	5	5	5	5	5	5	5	
27	4	8	9	9	9	5	9	9	9	9	8	8	I/D 85÷325=.261
28	4	9	8	5	5	5	5	5	8	8	8	8	i/d 47÷210=.223
29	5	4	8	8	4	8	8	4	8	8	8	8	
30	5	5	5	4	8	4	8	4	8	4	8	8	
31	4	4	8	8	3	3	4	4	8	8	3	3	
32	9	9	6	6	6	6	6	6	6	6	6	6	
33	5	2	2	2	6	6	6	6	6	6	6	6	
34	3	3	3	4	6	6	6	6	6	6	6	6	
35	6	6	6	6	6	6	6	6	6	6	6	6	
36	4	6	6	6	6	6	10	10	7	7	7	7	
37	9	9	9	9	2	3	3	3	3	4	8	2	
38	2	3	3	3	4	8	3	3	6	6	6	6	
39	6	6	6	6	6	6	6	6	6	6	6	6	
40	6	6	4	6	6	6	6	6	6	6	6	6	
41	7	7	7	7	9	9	9	3	3	2	6	6	
42	4	4	8	3	3	9	9	6	6	6	6	10	

OBSERVATION RECORD #25

Reproduction and Development

I-A — 7th Week

Time Minutes	Categories												Comment on Lesson
1	10	2	2	1	1	1	4	1	1	9	1	10	
2	1	1	1	5	5	5	4	4	8	8	2	2	
3	3	4	8	8	3	3	4	4	8	9	9	1	
4	3	3	9	9	9	1	1	1	1	5	5	4	
5	3	3	4	4	9	8	3	3	4	4	8	8	
6	3	4	4	8	9	9	8	3	4	4	4	8	
7	5	5	5	7	7	7	4	4	4	8	8	3	
8	8	3	9	9	9	9	1	1	1	1	5	5	Reproduction and Development
9	3	3	3	4	4	8	8	3	3	4	4	9	
10	1	4	4	8	8	3	3	10	4	8	8	2	
11	1	1	4	10	4	8	3	3	9	9	1	1	1. Male reproductive system.
12	3	4	4	8	8	9	9	9	9	1	1	1	
13	5	5	5	5	5	4	4	8	9	4	8	5	2. Female reproductive system.
14	1	1	1	5	5	5	4	4	9	9	9	8	
15	4	10	9	9	4	6	8	2	5	8	9	5	3. Development of zygote.
16	5	5	5	5	5	5	5	5	5	5	5	5	
17	2	5	5	5	5	5	5	5	5	5	5	5	4. Birth of the Child.
18	2	4	6	6	4	8	8	4	8	8	4	8	
19	8	9	6	9	6	6	6	6	6	6	6	6	5. Principles of heredity.
20	5	5	2	2	4	4	8	5	4	8	5	6	
21	8	8	4	4	8	9	9	3	3	4	4	9	
22	10	4	4	8	9	8	3	3	3	4	4	8	
23	8	2	5	5	5	4	4	8	9	9	3	3	Teacher talk.
24	3	5	5	4	4	8	8	3	3	3	5	5	323÷503=64%
25	4	2	4	9	9	9	9	3	3	3	4	4	
26	10	9	9	9	9	9	9	9	9	9	9	9	
27	8	4	9	9	9	9	4	4	8	4	8	9	Student talk.
28	8	8	4	8	5	8	4	8	8	9	9	9	160÷503=32%
29	3	3	4	4	10	9	5	5	2	4	4	4	
30	3	3	4	4	8	8	8	4	4	8	8	3	
31	8	8	8	3	3	3	4	4	8	8	8	3	Silence
32	3	3	5	5	5	2	4	5	5	4	4	8	20÷503=3.9%
33	4	4	9	9	9	3	3	4	4	8	8	3	
34	8	3	3	3	5	4	4	9	9	9	3	3	
35	5	5	5	5	4	4	8	8	8	4	8	2	I/D 208÷115=1.81
36	1	1	1	1	5	5	4	4	8	8	8	8	i/d 113÷ 28=4.03
37	4	10	10	10	4	6	8	4	5	8	8	5	
38	5	5	5	5	5	5	5	5	5	5	5	5	
39	5	2	4	6	6	4	8	8	4	8	8	4	
40	6	6	6	6	6	6	6	6	6	6	5	5	
41	9	2	2	5	9	9	9	9	3	3	4	5	
42	2	2	2	5	5	4	4	8	8	8	3	10	

OBSERVATION RECORD #26

Reproduction and Development

I-B

7th Week

Time Minutes	Categories												Comment on Lesson
1	10	5	5	5	5	5	5	4	4	8	8	4	
2	6	6	6	6	6	9	9	1	1	1	1	4	
3	8	4	8	4	5	5	5	5	5	5	5	9	
4	1	1	1	4	8	2	2	9	2	9	9	5	
5	2	2	4	4	8	3	3	3	2	1	1	4	
6	8	3	4	8	3	4	9	8	8	3	3	4	
7	4	4	8	8	3	3	9	8	3	4	8	3	
8	4	4	8	8	9	9	4	8	3	2	2	2	
9	5	5	5	4	8	8	4	8	8	4	8	9	
10	4	8	3	3	4	8	8	3	3	10	10	2	
11	10	6	20	6	6	6	4	4	8	5	4	8	
12	4	8	4	5	5	5	5	5	5	5	5	5	
13	9	2	2	9	2	2	2	6	6	5	5	5	
14	5	4	4	8	8	6	6	2	2	1	1	5	
15	4	8	4	8	3	5	5	5	5	5	5	5	
16	4	4	10	8	9	9	1	1	1	1	5	9	Teacher talk.
17	1	1	1	1	5	5	4	4	8	8	3	3	342÷503=68%
18	8	3	3	4	4	8	8	9	9	9	9	9	
19	3	3	4	4	8	8	9	9	9	4	8	8	
20	4	4	8	8	10	5	5	5	4	9	8	8	Student talk.
21	5	5	5	9	9	4	4	4	8	8	3	3	151÷503=30%
22	3	9	9	9	9	9	9	1	1	1	1	5	
23	5	8	8	9	3	5	5	5	4	4	8	8	
24	3	3	4	4	8	8	9	9	4	8	3	4	Silence.
25	4	4	8	8	2	2	2	4	4	8	5	2	10÷503=1.9%
26	5	9	5	5	4	9	9	9	4	8	5	8	
27	3	4	8	9	4	8	8	9	9	9	5	5	
28	5	4	8	8	2	2	9	9	8	8	2	2	I/D 225÷117=1.92
29	3	4	8	8	4	8	5	8	4	8	8	4	i/d 125÷20=6.25
30	5	3	3	4	5	10	10	5	5	4	8	2	
31	3	3	4	4	8	8	8	4	9	8	8	8	
32	4	4	8	8	8	2	2	4	9	8	8	8	
33	8	8	3	3	3	5	9	9	9	2	2	2	
34	8	3	3	4	4	8	8	3	9	9	4	4	
35	8	4	4	4	8	3	9	9	5	4	4	8	
36	2	2	2	2	5	5	5	5	4	4	8	8	
37	8	2	1	1	5	5	5	5	4	4	8	8	
38	5	5	5	5	4	4	8	8	4	10	10	10	
39	8	4	8	2	2	2	2	5	5	5	5	5	
40	6	6	6	6	6	6	6	4	4	8	4	8	
41	2	2	3	3	5	5	5	5	5	9	9	5	
42	4	8	2	3	3	4	8	2	2	3	4	10	

OBSERVATION RECORD #27

Reproduction and Development

D-A — 7th Week

Time Minutes	Categories												Comment on Lesson
1	10	7	5	5	5	6	9	9	9	2	2	5	
2	5	5	5	5	5	5	5	5	5	5	5	5	
3	6	9	9	10	9	2	2	1	1	3	3	4	
4	4	9	9	6	9	2	2	2	2	3	5	3	
5	5	5	6	6	6	6	6	6	6	6	6	6	
6	4	8	8	2	2	5	7	7	7	7	5	6	
7	9	4	4	7	7	8	4	4	8	1	1	1	
8	5	5	5	5	5	5	5	5	5	5	5	5	
9	4	4	8	6	6	3	5	5	5	5	5	5	
10	6	6	6	6	6	6	6	6	6	6	6	6	
11	4	2	2	3	3	3	5	4	6	6	6	8	
12	8	8	8	8	8	6	6	6	6	6	6	6	
13	6	6	6	6	4	8	8	8	6	6	6	4	
14	8	8	8	8	6	6	8	8	6	6	5	5	Teacher talk.
15	5	5	5	5	5	5	5	5	5	5	5	5	418÷503=83%
16	5	6	6	5	5	5	5	5	5	5	5	5	
17	6	6	6	6	6	5	5	2	5	5	5	5	Student talk.
18	10	10	10	5	5	5	5	5	5	5	3	3	78÷503=16%
19	5	5	5	4	8	3	4	8	3	4	8	8	
20	3	5	5	2	2	5	5	5	5	5	5	5	
21	5	5	5	4	5	4	4	10	4	4	8	8	Silence.
22	3	3	4	8	3	5	5	4	4	8	3	3	7÷503=1.3%
23	4	8	3	3	4	8	4	2	4	9	9	9	
24	9	2	2	2	3	3	6	6	6	6	6	6	
25	4	2	2	3	3	3	3	5	4	8	8	8	I/D 130÷288=.451
26	4	4	8	8	3	5	5	5	5	5	4	4	i/d 76÷148=.513
27	8	5	5	5	6	6	5	5	5	5	5	5	
28	6	6	6	6	6	6	6	6	6	6	6	6	
29	6	6	6	6	6	6	6	6	6	6	6	6	
30	9	9	9	5	5	5	6	6	5	5	5	5	
31	4	4	8	8	8	3	3	5	5	5	5	5	
32	4	4	8	8	3	3	5	5	5	6	6	5	
33	3	5	5	5	5	5	5	5	5	2	2	5	
34	7	4	4	7	7	8	4	4	8	3	3	4	
35	4	4	8	8	8	7	7	4	4	8	3	3	
36	4	7	7	3	3	5	7	7	7	7	7	7	
37	5	6	6	6	6	6	6	6	6	6	6	6	
38	9	2	2	2	3	6	6	6	6	6	6	6	
39	4	2	2	3	3	3	5	4	8	4	4	8	
40	6	6	6	6	6	6	6	6	6	6	6	6	
41	4	4	8	8	8	2	3	3	5	6	6	6	
42	4	4	6	6	2	4	8	2	4	8	2	10	

OBSERVATION RECORD #31

Bacteria and Related Organisms

D-A — 8th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	4	4	8	8	4	4	8	8	4	8	6	6	
3	5	5	5	5	5	5	5	5	5	5	5	5	
4	5	5	5	5	5	5	5	5	5	5	5	5	
5	6	6	6	6	6	6	6	5	5	4	10	8	
6	5	5	5	5	5	6	6	6	6	6	6	6	
7	3	5	5	5	5	5	5	5	5	5	5	5	
8	5	5	5	5	4	8	3	4	8	2	4	8	
9	3	5	5	5	5	5	5	5	5	5	5	5	
10	5	5	5	5	5	4	4	10	10	4	8	8	Teacher talk.
11	3	3	4	8	3	5	5	4	4	8	3	3	412÷503=82%
12	4	8	3	3	4	8	4	8	4	9	9	9	
13	2	2	2	3	3	3	6	6	6	6	6	6	
14	4	2	2	3	3	3	3	5	4	8	8	8	
15	4	8	8	3	5	5	5	5	4	4	4	4	Student Talk.
16	8	5	5	5	5	5	5	5	5	5	5	5	79÷503=16%
17	6	6	6	6	6	6	6	6	6	6	6	6	
18	6	6	6	6	6	6	6	6	6	6	6	6	
19	9	9	9	5	5	5	5	5	5	5	5	5	
20	4	4	8	8	8	3	3	5	5	5	5	5	Silence.
21	4	4	8	8	3	3	5	5	5	5	5	5	12÷503=2.4%
22	9	4	4	8	8	8	4	4	8	3	3	3	
23	4	4	8	8	3	3	5	7	7	7	7	7	
24	4	4	8	8	8	10	10	4	4	8	3	3	I/D 131÷281=.466
25	4	8	8	3	3	3	7	7	7	7	7	7	i/d 74÷127=.582
26	5	6	6	6	6	6	6	6	6	6	6	6	
27	9	9	9	9	3	3	3	3	5	5	5	5	
28	9	9	9	9	3	3	3	5	5	5	5	5	
29	9	8	8	4	8	9	5	5	5	5	5	5	
30	9	2	2	2	3	3	6	6	6	6	6	6	
31	4	2	2	3	3	3	5	4	8	4	4	8	
32	6	6	6	6	6	6	6	6	6	6	6	6	
33	4	4	8	8	8	3	3	5	5	5	5	5	
34	5	5	5	5	5	5	5	5	5	5	5	5	
35	9	4	4	8	8	8	4	4	8	3	3	3	
36	4	8	8	3	3	5	7	7	7	5	6	6	
37	6	6	6	6	6	6	6	6	6	6	6	6	
38	9	9	9	9	3	3	3	3	5	3	5	5	
39	5	5	5	5	5	5	5	5	5	5	5	5	
40	6	9	9	9	10	10	2	1	2	3	3	4	
41	5	5	5	10	5	4	4	4	10	4	4	8	
42	9	1	1	1	3	5	5	4	4	8	3	10	

OBSERVATION RECORD #28

Reproduction and Development

D-B

7th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	9	6	5	5	5	5	5	5	5	5	5	5	
3	3	5	5	4	6	6	5	5	5	5	5	5	
4	5	5	6	6	9	9	5	5	5	5	5	5	
5	4	4	8	8	6	6	3	3	4	4	6	6	
6	3	3	6	6	6	6	6	6	6	6	6	6	
7	5	5	5	5	5	5	5	5	5	5	5	5	
8	6	5	8	8	3	6	4	4	8	8	3	3	
9	6	6	6	6	6	6	6	6	6	6	6	6	
10	5	2	2	5	5	5	5	5	5	6	5	5	
11	3	3	3	4	5	5	5	5	6	5	6	5	
12	5	5	6	6	6	5	6	6	5	5	6	5	
13	5	5	6	5	5	5	6	5	5	5	5	5	
14	4	6	6	6	6	10	10	10	7	7	7	7	Teacher talk,
15	9	9	6	6	2	6	3	3	5	5	5	5	434÷503=86%
16	5	2	2	5	6	5	5	5	5	5	5	5	
17	3	3	7	4	7	5	5	6	6	5	5	5	
18	5	5	4	6	6	6	6	6	6	6	10	7	Student talk.
19	7	7	7	7	9	6	6	3	3	2	5	5	62÷503=12%
20	5	5	5	5	5	5	5	5	5	5	5	5	
21	5	2	2	5	5	5	5	5	5	5	5	5	
22	6	6	6	6	6	6	6	6	6	6	6	6	Silence
23	4	8	8	4	6	6	6	8	8	8	8	8	7÷503=1.3%
24	4	8	5	8	6	8	8	8	8	4	9	6	
25	9	4	8	6	4	8	4	8	5	5	6	8	
26	5	5	5	6	6	8	8	8	8	6	8	5	I/D 85÷349=.243
27	8	4	4	6	2	2	3	3	8	8	4	8	i/d 43÷163=.263
28	8	4	9	4	4	6	4	6	6	4	8	2	
29	9	5	5	6	4	6	6	8	8	5	6	6	
30	6	5	5	5	5	5	5	5	6	5	5	5	
31	6	6	6	6	6	6	6	6	6	6	6	6	
32	4	8	8	3	3	3	5	7	7	7	7	7	
33	7	5	5	5	5	5	5	5	6	5	5	5	
34	7	5	5	6	5	5	5	5	5	5	5	5	
35	6	6	6	6	6	6	6	6	6	6	6	6	
36	4	4	8	8	3	3	4	8	2	3	6	4	
37	8	8	3	3	5	5	4	4	4	4	4	4	
38	6	6	8	8	3	5	5	4	8	8	5	5	
39	5	5	5	6	6	5	5	6	7	5	5	5	
40	3	5	5	4	8	3	5	5	5	5	5	5	
41	9	9	5	5	5	5	7	5	5	5	10	5	
42	6	6	6	6	6	6	6	6	6	6	6	10	

OBSERVATION RECORD #30

Bacteria and Related Organisms

I-B 8th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	5	2	4	6	6	4	4	8	8	4	9	9	
3	4	8	2	6	5	6	6	6	5	5	6	6	
4	5	5	6	4	4	4	5	4	4	4	9	9	
5	2	2	2	1	1	1	1	2	1	1	1	9	
6	1	10	1	1	1	5	5	4	4	8	8	2	
7	2	4	8	8	2	2	4	4	10	8	9	9	
8	1	2	2	9	9	9	1	1	1	1	5	6	
9	4	4	8	8	2	2	2	3	3	3	6	5	
10	3	3	4	4	8	8	3	6	3	4	4	8	
11	8	3	4	4	8	8	6	8	3	6	4	4	
12	5	5	5	7	7	7	4	4	4	8	8	3	
13	8	6	9	9	9	9	1	1	1	1	5	5	Teacher talk.
14	3	6	3	9	4	8	8	3	3	4	8	2	337÷503=67%
15	1	4	9	8	8	3	6	10	4	8	8	3	
16	1	1	4	10	4	8	6	3	3	9	9	1	
17	1	3	4	4	8	8	9	9	9	9	1	1	Student talk.
18	5	5	5	5	6	4	4	8	8	4	4	4	153÷503=30%
19	1	5	5	6	5	5	9	4	8	8	8	8	
20	4	10	10	6	4	6	8	2	5	8	8	5	
21	5	9	5	6	6	5	6	5	5	5	5	9	Silence.
22	4	4	8	2	6	3	3	5	9	5	5	9	13÷503=2.5%
23	2	4	6	6	4	8	8	4	8	8	4	8	
24	8	8	8	6	10	6	6	6	6	6	6	6	
25	5	9	2	2	4	4	8	8	4	8	5	8	I/D 213÷124=1.72
26	4	4	8	8	2	6	3	6	3	6	4	8	i/d 117÷ 63=1.85
27	8	8	2	5	5	9	4	8	8	8	2	2	
28	3	3	9	5	9	9	4	8	8	9	2	2	
29	3	9	5	9	5	2	9	9	2	9	9	9	
30	3	3	3	3	10	9	9	9	9	9	10	9	
31	9	9	9	9	9	9	7	7	7	7	8	8	
32	4	8	8	4	4	2	9	5	5	10	10	4	
33	4	9	2	2	5	5	9	9	4	4	3	3	
34	9	8	8	4	4	8	8	8	8	4	4	8	
35	3	3	4	8	8	6	6	2	2	2	2	5	
36	5	4	8	8	4	8	8	4	8	8	4	8	
37	8	4	4	8	9	3	3	4	8	3	2	2	
38	2	4	4	8	8	3	6	4	8	3	2	2	
39	2	4	4	8	8	6	3	4	8	3	4	8	
40	3	4	8	3	4	8	3	4	4	8	8	3	
41	2	2	9	2	2	6	6	6	5	4	8	4	
42	5	5	5	6	6	5	5	5	5	5	5	10	

OBSERVATION RECORD #29

Bacteria and Related Organisms

I-A 8th Week

Time Minutes	Categories												Comment on Lesson
1	10	1	9	1	1	2	1	1	2	2	2	2	
2	6	6	6	6	6	6	6	6	6	6	6	6	
3	5	2	4	6	6	6	4	8	8	4	8	8	
4	4	2	5	5	5	5	5	5	5	5	5	5	Bacteria and Related Organism.
5	5	5	5	5	5	5	5	5	5	5	5	5	
6	4	10	10	10	4	8	2	5	9	9	9	5	
7	1	1	1	5	5	5	4	4	8	8	9	9	1. The nature of bacteria.
8	5	5	5	5	4	4	8	8	8	4	4	4	
9	8	3	3	3	5	4	4	8	8	8	3	3	2. Forms of bacteria
10	4	4	8	8	3	3	4	4	8	8	3	3	3. Conditions for growth.
11	3	5	5	5	2	2	5	5	4	4	8	8	
12	8	8	3	3	3	4	4	8	8	8	3	3	4. Saprophytes and parasites
13	3	3	4	4	8	8	8	4	4	8	8	2	
14	2	2	3	3	5	5	4	8	2	3	3	4	5. Bacterial reproduction.
15	4	8	8	4	4	8	8	2	2	2	4	4	
16	10	10	5	5	3	3	4	4	8	8	4	8	
17	5	8	4	8	8	8	8	9	9	9	9	9	
18	9	9	4	4	8	4	8	9	7	7	9	9	Teacher talk.
19	9	9	10	9	9	9	9	10	9	9	9	9	323÷503=64%
20	10	9	9	9	9	9	9	2	2	2	9	9	
21	9	9	9	3	3	3	5	5	4	4	8	8	
22	3	3	3	5	5	5	5	2	2	5	5	5	Student talk.
23	4	4	8	8	8	3	3	3	4	4	8	8	160÷503=32%
24	8	3	3	3	4	4	8	8	8	4	4	8	
25	8	3	3	4	4	10	10	5	5	2	2	4	
26	4	8	8	4	8	5	8	8	8	6	10	6	Silence.
27	6	6	6	6	6	2	4	6	6	4	8	8	20÷503=3.9%
28	4	8	8	4	8	2	5	5	5	5	5	5	
29	5	5	5	5	5	5	5	5	5	5	5	5	I/D 209÷114=1.83
30	4	10	10	10	4	6	8	2	5	8	8	5	i/d 109÷ 29=3.75
31	1	1	1	5	5	5	4	4	8	8	8	8	
32	5	5	5	5	5	4	4	8	8	4	4	4	
33	3	4	4	8	8	9	9	9	9	1	1	1	
34	1	1	4	10	4	8	3	3	9	9	9	9	
35	4	4	8	8	3	3	4	4	8	8	4	8	
36	9	9	9	9	9	1	1	1	1	5	5	5	
37	5	9	9	9	9	9	4	4	4	8	8	4	
38	4	4	4	8	8	10	8	3	9	4	4	8	
39	4	4	9	9	9	1	1	1	1	9	9	4	
40	4	4	8	3	3	4	4	10	9	9	9	9	
41	1	1	1	6	6	4	4	4	8	2	4	8	
42	2	2	2	1	1	1	2	1	1	9	1	10	

OBSERVATION RECORD # 32

Bacteria and Related Organisms

D-B

8th Week

Time Minutes	Categories												Comment on Lesson
1	10	6	6	6	6	6	6	6	6	6	6	6	
2	6	6	4	6	8	8	8	8	8	8	8	8	
3	4	6	8	8	6	4	8	8	6	4	8	8	
4	5	5	5	5	5	5	5	5	5	5	5	5	
5	5	5	5	5	5	5	5	5	5	5	5	5	
6	5	5	5	5	5	5	5	5	5	5	5	5	
7	5	5	5	5	6	4	8	6	6	6	6	6	
8	6	6	6	6	6	5	5	5	5	5	5	5	
9	10	10	6	5	5	5	5	5	5	3	3	3	
10	5	5	5	4	8	3	4	8	3	4	8	8	
11	3	5	5	5	5	5	5	5	5	5	5	5	
12	5	5	5	4	5	4	4	10	4	4	8	8	
13	3	3	4	8	3	5	8	4	4	8	3	3	
14	4	8	3	3	4	8	4	4	8	4	9	9	
15	9	2	2	2	3	3	6	6	6	6	6	6	
16	4	2	2	3	3	3	3	5	4	8	8	8	Teacher talk.
17	4	4	8	8	3	3	3	3	3	6	4	4	421÷503=84%
18	8	6	6	5	5	5	5	5	5	5	5	5	
19	6	6	6	6	6	6	6	6	6	6	6	6	
20	6	6	6	6	6	6	6	6	6	6	6	6	Student talk.
21	9	9	9	5	5	5	5	5	5	5	5	5	77÷503=15%
22	5	4	8	6	6	6	6	5	6	5	5	5	
23	4	4	8	6	3	3	5	6	5	6	5	3	
24	5	5	5	5	5	5	5	5	5	5	5	5	
25	9	4	4	8	8	8	4	4	8	3	3	4	Silence.
26	4	4	8	8	8	8	4	4	8	3	3	4	5÷503=.9%
27	8	8	3	3	5	7	7	7	7	7	7	7	
28	5	6	6	6	5	6	6	6	6	6	6	6	
29	9	9	9	9	9	3	3	3	3	3	5	5	I/D 98÷323=.303
30	4	8	6	4	8	6	5	5	5	5	5	5	i/d 47÷160=.293
31	4	8	8	6	6	6	6	6	6	6	6	6	
32	4	4	6	8	3	3	5	7	7	7	7	5	
33	6	6	6	6	6	6	6	6	6	6	6	6	
34	4	4	8	8	8	3	3	5	5	5	5	5	
35	5	5	5	5	5	5	5	5	5	5	5	5	
36	9	4	4	8	8	8	4	4	8	8	6	6	
37	4	8	8	3	3	5	7	7	7	7	5	6	
38	6	6	6	6	6	6	6	6	6	6	6	6	
39	5	5	5	5	5	5	5	5	5	5	5	5	
40	7	5	5	5	6	6	9	9	3	3	5	6	
41	6	6	6	6	6	4	8	8	8	8	10	10	
42	6	6	6	6	6	6	6	6	6	6	6	10	

APPENDIX B

STUDENT PERCEPTION OF TEACHER'S
VERBAL BEHAVIOR

Check List

Please answer the following questions honestly and frankly. Do not give your name. To encourage you to be frank, your regular teacher should be absent from the classroom while these questions are being answered. Your teacher will receive a summary of the answers by the students in your class.

After completing this checklist, sit quietly or study until all students have completed their reports.

Check five (5) of the categories that you think describes your teacher's Verbal Behavior.

_____1. ACCEPTS FEELING: Accepts and clarifies the feeling tone of the student in a non-threatening manner.

_____2. PRAISES OR ENCOURAGES: praises or encourages student action behavior. Jokes that release tension, but not at the expense of another individual.

_____3. ACCEPTS OR USES IDEAS OF STUDENTS: clarifying, building, or developing ideas suggested by a student.

_____4. ASKS QUESTIONS: asking a question about content or procedure with the intent that a student answer.

_____5. LECTURING: giving facts or opinions about content or procedures; expressing his own ideas, asking rhetorical questions.

_____6. GIVING DIRECTIONS: directions, commands, or orders to which a student is expected to comply.

_____7. CRITICIZING OR JUSTIFYING AUTHORITY: statements intended to change student behavior from non-acceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.

APPENDIX C

TABLE 8

I-A (EXPERIMENTAL)

Biology Achievement Test Scores

Student	Sex	Age	Pretest	Posttest	Gains
A	F	15	42	61	19
B	F	15	26	40	14
C	M	15	33	46	13
D	M	15	26	38	12
E	M	15	31	43	12
F	M	15	21	33	11
G	F	16	33	44	11
H	F	14	36	46	10
I	M	16	27	37	10
J	F	14	24	33	10
K	F	15	42	51	9
L	F	14	29	39	9
M	F	17	34	40	7
N	F	15	26	33	6
O	F	14	34	40	6
P	F	17	34	40	6
Q	M	15	37	43	6
R	M	14	31	36	5
S	M	16	42	46	4
T	F	15	25	29	4
			EX= 633	EX= 818	185

$E(X-X)^2 = 282$

$$\text{Pretest } X = \frac{EX}{N} = \frac{633}{20} = \underline{31.65}$$

$$\text{Posttest } \overline{X} = \frac{EX}{N} = \frac{818}{20} = \underline{40.9}$$

$$40.9 - 31.65 = 9.25$$

$$SX^2 = \frac{282}{20} = 14.1$$

$$SX = \sqrt{14.1}$$

$$SX = 3.7$$

$$SX^2 = \frac{321}{20} = 16.05$$

$$SX = \sqrt{16}$$

$$SX = \underline{4}$$

TABLE 9

I-B EXPERIMENTAL

Student	Sex	Age	Pretest	Posttest	Gains
A	F	15	31	48	17
B	M	15	41	57	16
C	F	15	24	36	12
D	M	15	41	43	12
E	M	15	9	20	11
F	M	16	33	44	11
G	F	14	53	61	8
H	F	15	34	41	7
I	F	15	38	45	7
J	F	14	33	39	6
K	F	15	28	33	5
L	M	16	44	48	4
M	F	17	27	31	4
N	M	16	37	41	4
O	F	16	23	26	3
P	F	15	41	42	1
Q	F	14	43	43	0
R	F	14	27	27	0
S	M	16	23	22	-1
T	F	18	28	26	-2
			EX = 648	EX = 773	125

Pretest $\bar{X} = \frac{EX}{N} = \frac{648}{20} = \underline{32.4}$

$SX^2 = \frac{360}{20} = 18$

$SX = \sqrt{18}$

$SX = \underline{4.2}$

$E(X-\bar{X})^2 = 360$

Posttest $\bar{X} = \frac{EX}{N} = \frac{773}{20} = \underline{38.65}$

$38.65 - 32.4 = 6.25$ or 6.3

$SX^2 = \frac{583}{20} = 29$

$SX = \sqrt{29}$

$SX = \underline{5.4}$

$E(X-\bar{X})^2 = 583$

TABLE 10

D-A CONTROL

Student	Sex	Age	Pretest	Posttest	Gains
A	F	16	27	43	16
B	F	15	41	51	10
C	F	15	32	41	9
D	M	15	22	29	7
E	F	15	28	34	6
F	M	17	34	40	6
G	F	16	26	31	5
H	M	15	41	45	4
I	M	17	6	10	4
J	M	15	22	26	4
K	F	18	16	19	3
L	F	14	27	30	3
M	F	15	45	48	3
N	M	15	27	29	2
O	F	14	41	42	1
P	F	14	31	32	1
Q	F	15	22	21	-1
R	M	15	34	33	-1
S	F	15	33	30	-3
T	M	17	41	37	-4
			EX = 596	EX = 671	75

Pretest $\bar{X} = \frac{EX}{N} = \frac{596}{20} = \underline{29.8}$

Posttest $\bar{X} = \frac{EX}{N} = \frac{671}{20} = 33.55$

$33.5 - 29.8 = \underline{3.7}$

$E(X-\bar{X})^2 = 313$

$SX = \frac{313}{20} = \underline{15.65}$

$SX = \sqrt{15.7}$

$SX = 3.9$

$E(X-\bar{X})^2 = 614$

$SX^2 = \frac{614}{20}$

$SX = \sqrt{30.7}$

$SX = 5.5$

TABLE 11

D-B CONTROL

Student	Sex	Age	Pretest	Posttest	Gains
A	F	17	14	34	20
B	F	15	21	33	12
C	F	16	7	18	11
D	M	15	36	46	10
E	F	16	27	37	10
F	F	14	27	35	8
G	F	14	29	38	9
H	F	17	34	40	6
I	F	14	35	40	5
J	M	15	22	26	4
K	F	15	25	29	4
L	M	17	37	40	3
M	F	15	38	41	3
N	F	16	30	33	3
O	M	16	25	27	2
P	F	18	26	28	2
Q	F	15	25	26	1
R	M	14	22	23	1
S	M	15	20	21	1
T	F	15	22	23	1
			EX= 522	EX = 638	116

Pretest $\overline{X} = \frac{EX}{N} = \frac{522}{20} = 20.1$

Posttest $\overline{X} = \frac{EX}{N} = \frac{638}{20} = 31.9$

$31.9 - 26.1 = 5.8$

$E(X-\overline{X})^2 = 390$

$SX^2 = \frac{390}{20} = \underline{19.5}$

$SX \quad \sqrt{19.5}$

$SX = \underline{4.4}$

$E(X-\overline{X})^2 = \underline{541}$

$SX^2 = \frac{541}{20} = 27.05$

$SX = \frac{541}{20} = 27.05$

$SX = \sqrt{27}$

$SX = 5.19$ or 5.2

APPENDIX D

ACHIEVEMENT EXAMINATIONS FOR SECONDARY SCHOOLS

FORM 4 — B I O L O G Y — Time: 1½ hrs.

Student's Score.....

Perfect Score: 108

Dr. B. R. Whittinger, Author
University of Minnesota High School

NAME.....
Last First Middle Initial Age Grade

City (or P.O.Address).....County.....Dist. No.....Time Used.....

Name of Parents.....Address.....

To the student: Be sure to fill out the blanks above. Read directions carefully and answer the questions on this sheet: no other sheet is needed except scratch paper. If you cannot answer a question, leave it and go on to the next one. Answer as many as you can.

I. DIRECTIONS: Write in each answer space the letter of the best response.

1. The fruit of a plant (a) is sweet (b) has much stored food (c) contains the seeds (d) consists of the ovary..... 1.(...)

2. Animals have the same functions as plants except for (a) respiration (b) irritability (c) reproduction (d) excretion (e) photosynthesis ..... 2.(...)

3. Identical twins originate from (a) two eggs fertilized by one sperm (b) one egg fertilized by two sperms (c) two eggs fertilized by two sperms (d) one egg fertilized by one sperm..... 3.(...)

4. The essential organs of the flower are (a) petals and pistils (b) sepals and corolla (c) pistils and stamens (d) stamens and calyx..... 4.(...)

5. Growth and repair of body tissues involves (a) protein (b) fats (c) starch (d) sugar..... 5.(...)

6. The human embryo gets its food through (a) the placenta (b) the uterine tube (c) cell division (d) the mother's blood stream directly.... 6.(...)

7. When the habitat of an organism changes, that organism (a) usually increases in number (b) becomes extinct there (c) usually must change in structure or life habitat or become extinct (d) usually is not affected (e) usually dies in great numbers from disease..... 7.(...)

8. The post-natal period of greatest growth is (a) the fetus (b) infancy (c) the embryo (d) childhood (e) adolescence..... 8.(...)

9. A bald-headed father and a straight haired mother have children who have curly hair. Straight hair is a recessive trait. The explanation for

9. (continued)
the children having curly hair is
(a) the mother carried genes for curly hair which she passed on to her offspring
(b) the father carried genes for curly hair which he passed on to his offspring
(c) both the mother and father carried genes for curly hair (d) neither parent had an influence in determining the type of hair in the offspring..... 9.(...)

10. Bacteria
(a) need air to grow (b) are produced by toxins (c) are smaller than viruses (d) are macroscopic (e) more than one of the above (f) none of the above.....10.(...)

11. Girdling is likely to be destructive to a tree because
(a) the growing tissue is likely to be squeezed (b) the conducting tissue may be destroyed (c) the stem cannot get air (d) the roots will be extruded by osmotic pressure.....11.(...)

12. Secretions of endocrine glands are referred to as
(a) enzymes (b) lymph (c) toxins (d) hormones (e) anti-toxins.....
.....12(...)

13. Reference to an organism indicates
(a) anything made up of organs
(b) anything consisting of organic matter (c) any living thing (d) a systemic organization.....13.(...)

14. A person with blood type "O" may give blood to another person with blood type
(a) A (b) B (c) AB (d) more than one of the above.....14.(...)

15. When two brown eyed parents have a blue eyed child it probably indicates
(a) hybird eye genes in one parent
(b) a mutation (c) hybird eye genes in both parents (d) this result is impossible.....15.(...)

16. Proteins are different from the other energy foods in that they contain
(a) nitrogen (b) oxygen (c) hydrogen (d) carbon....16.(...)

17. The history of the payment of bounties for the destruction of predators indicates
(a) the results justified the outlay of necessary funds
(b) the destruction of the predators corrected the balance of nature (c) the predator program disrupted the balance of nature (d) the program provided a much stronger game animal population.....17.(...)

18. Plants that grow each year from seeds are
(a) biennials (b) annuals (c) spermatophytes (d) perennials.....18.(...)

19. The unique contribution legumes make to the soil in which they are planted, is
(a) the fortifying of the calcium content (b) the rich supply of humus (c) the fortification of nitrates by harboring nitrogen fixers (d) the production of a superior mulch.....19.(...)

20. In a symbiotic relationship
(a) two things of the same species exist together (b) a living thing lives on organic matter which is dead (c) two things live in a parasite-host relationship (d) two living things associate in life with mutual benefit.....20.(...)

21. Tissue is best illustrated by
(a) similar cells working together in a common function (b) such structures as the brain, heart, kidney or

21. (continued) stomach (c) simple organisms such as the amoeba or paramoecium (d) anything that contains an amount of protoplasm.....21.(...)

22. The outstanding contribution of the scientist Linnaeus, was (a) the germ theory of disease (b) the modern system of classification (c) the cell theory of structure (d) the principle of mutation in heredity.....22.(...)

23. A great majority of mutations (a) are desirable characteristics (b) are not hereditary (c) are recessive characteristics (d) are dominant traits.....23.(...)

24. All living cells have (a) cell walls (b) protoplasm (c) nuclei (d) chloroplasts...24.(...)

25. The arthropods are especially well known as (a) the only phylum with jointed appendages (b) the only phylum with the largest number of known species (c) the animals with backbones (d) animals with six legs... .....25.(...)

26. Red four-o'clocks crossed with white four-o'clocks produce pink. This demonstrates the law of (a) unit character (b) segretation (c) dominance (d) incomplete dominance.....26.(...)

27. The latest evidence in the studies of the effect of alcohol on the human body indicate (a) alcohol causes very little if any physical breakdown (b) alcohol is a powerful stimulant in its effect on the nervous system (c) alcohol would make an effective anesthetic (d) alcoholic types can be very easily grouped or classified...27.(...)

28. An impermeable membrane (a) allows the passage of a given substance in one direction (b) allows passage of a given substance in both directions (c) prevents the passage of a given substance (d) allows the passage of any substance.....28.(...

29. Certain living things are peculiar to Austrailia because of (a) natural barriers (b) marked climatic differences (c) altitude effects (d) marked latitude differences..29.(...

30. Scientists believe that the genes for sex-linked traits (a) are located on the "X" chromosome (b) are located on the "Y" chromosome (c) are always passed from father to son (d) are always recessive traits.....30.(...)

31. Wherever the numbers of different kinds of plants and animals tend to remain approximately the same in a given place, there exists (a) an emigration (b) a biological succession (c) a changing environment (d) a balance of nature.....31.(...)

32. Mary wish to cook some dried peaches; but since they had quite a tart taste, she added a large amount of sugar to the water. The best explanation for the result would be (a) the sugar would easily diffuse into the fruit (b) osmosis would be increased in the direction of the fruit (c) the fruit would not become as plump as it should (d) turgidity of the fruit would be increased.....32.(...

33. The eye defect known as far-sightedness can be corrected by
(a) use of a concave lens (b) use of a triangular lens (c) use of a convex lens (d) merely exercising the eyes..... 33.(...)

34. To produce active immunity in the human body
(a) toxins may be injected to promote formation of anti-bodies (b) anti-toxin may be injected to help the body resist an infection (c) exposure to the disease would produce best results (d) inheritable conditions can be relied on to produce desirable results..... 34.(...)

35. Man's success as an organism can be attributed to
(a) more efficient muscular development (b) more highly developed sense of sight (c) highly developed cerebrum (d) fixed inborn behavior patterns..... 35.(...)

36. Osmosis is characterized by
(a) diffusion of gases through a permeable membrane (b) movement of particles through a membrane from the greater to lesser density (c) diffusion of color through an impermeable membrane from greater to lesser concentration (d) diffision of water through a semi-permeable membrane for greater to lesser concentration..... 36.(...)

37. The presence of Chlorophyll in plants
(a) enables plants to withstand plasmolysis (b) enables plants to produce food (c) gives a green color (d) increases the rate of transpiration..... 37.(...)

38. Plant cells produce a commercially important product called
(a) fibrinogen (b) toxoid (c) cellulose (d) hyalin..... 38.(...)

39. Oviparous animals differ from viviparous in having
(a) a gestation period (b) external fertilization (c) internal development (d) an incubation period... 39.(...)

40. The center of reflex activity is mainly in the
(a) cerebrum (b) cerebellum (c) spinal cord (d) sensory neuron..... 40(...)

41. The main characteristic of insects is
(a) six legs (b) four wings (c) antennae (d) exo-skeleton..... 41.(...)

42. White blood cells differ from red blood cells in that they
(a) are much smaller (b) carry oxygen to the living cells (c) remain fairly constant (d) move out of blood vessels into tissue spaces. 42.(...

43. Berger's disease is usually associated with
(a) vitamin deficiency (b) use of tobacco (c) kidney conditions (d) the use of narcotic substances..... 43.(...)

44. A biology class tried to determine the effectiveness of two hand-lotions. Lotion "A" and lotion "B" were applied to a randomly selected group of 50 right-handed people, alternating the two lotions between the two hands on each subject without the subject's knowledge of which lotion was placed on which hand. One recommendation we could make for this plan would be
(a) place the same lotion on both hands (b) include a third classification of no lotion or false lotion on a third of the subjects (c) place the lotions A or B on the same hand, right or left (d) mix the two lotions together before applying..... 44.(...

45. The downward curling of a leaf at various times
(a) reduces transpiration (b) increases photosynthesis (c) indicates increase in osmosis (d) is due to rapid respiration..... 45.(...

46. The cambium of a stem
(a) provides for oxygen exchange
(b) increases the diameter of a stem
(c) is the principal conductor of fluids (d) increases the length of a stem.....46.(...)

47. The mathematical sex ratio tends to be
(a) 3:1 (b) 2:1 (c) 2:2
(d) 8:10.....47.(...)

48. Evergreens are plants which
(a) do not drop their leaves
(b) drop their leaves in the fall
(c) drop their leaves in the spring
(d) do not drop all leaves at the same time.....48.(...)

49. The start of a young plant in seed is
(a) a cotyledon (B) an hilum (c) an endosperm (d) an embryo.....49.(...)

50. Monocot stems are different from Dicot stems in that
(a) the vascular bundles are scattered in the monocot (b) the monocot stem has no support (c) monocots have no vascular bundles (d) dicot stems have no pith.....50.(...)

51. Pollination has occurred when
(a) pollen has been transferre from flower to flower (b) the sperm cell unites with the egg cell (c) pollen has been transferred from stamen to pistil (d) pollen has been transferred from pistil to stamen.....51.(...)

52. The main devices of water absorption in the plant are the
(a) stomata (b) lenticles
(c) cuticle (d) root hairs.....52.(...)

53. In mitosis the chromosones
(a)double in number (b) remain the same in number (c) triple in number
(d) are reduced in half.....53.(...)

54. A disease associated with lack of iodine in the diet is
(a) cancer (b) diabetes
(c) simple goiter
(d) yellow fever (e) arterial sclerosis.....54.(...)

55. In diabetes the excess sugar goes into the urine. A doctor testing a urine specimen for sugar would use
(a) iodine (b)phenolphthalein
(c) Fehling's solution
(d) lime water.....55.(..

56. Which of the following contains all the rest?
(a) codeine (b) opium (c) morphine (d) heroin.....56.(..

57. Geotropism is the
(a) tendency of a plant to grow toward the sun
(b) study of geographical influence (c) tendency of man to migrate (d) tendency of plant roots to respond to gravity.....57.(..

58. We would expect to find no nervous system in the
(a) earthworm (b) amoeba
(c) fish (d) hydra.....58.(..

59. If a moth causes damage by chewing, we would blame it on the
(a) adult (b) nymph
(c) larvae(d) pupae.....59.(..

60. A disease very often associated with hookworm, in countries with high percentage of infection is
(a) trichinosis (b) tuberculosis
(c) ascaris (d) taenia.....60.(..

DIRECTION: In each of the following statements, one term is not related to the others in the group Select the letter of the misfit and place it in the answer space.

61. (a) mushroom (b) wheat rust
(c) diatoms (d) bread mold..61.(..

62. (a) mistletoe (b) lichen
(c) tubercular bacillus
(d) lilac mildew.....62.(..

63. (a) spores (b) fission (c) budding
(d) conjugation.....63.(..

64. (a) spider (b) locust
(c) katydid (d) cockroach....64.(...)

65. (a) garter snake (b) painted turtle (c) skunk
(d) tiger salamander.....65.(...)

66. (a) respiration (b) osmosis
(c) irritability (d) reproduction.....66.(...)

67. (a) pituitary (b)thyroid
(c) salivary (d) adrenal.....67.(...)

68. (a) egg (b) pupa (c) larva
(d) nymph.....68.(...)

69. (a) Bantin (b) deVries
(c) Mendel (d) Thomas Morgan.69.(...)

70. (a) Plumule (b) hypocotyl
(c) cotyledon (d) cambium....70.(...)

III DIRECTIONS: Write in each answer space the letter of the term that includes all the rest.

71. (a) sensory (b) motory
(c) associative (d)neuron....71.(...)

72. (a) insulin (b) hormone
(c) thyroxin (d) estrogen....72.(...)

73. (a) enzyme (b) pytalin
(c) pepsin (d) trypsin.....73.(...)

74. (a) protozoa (b) bacillus
(c) micro-organisms
(d) bacteria..... 74.(...)

75. (a) veins (b) leaf (c) midrib
(d) petiole..... 75.(...)

IV. DIRECTIONS: Select the letter of the phylum which best fits each description and place it in the answer space after the description. Some phyla may be used more than once, and some may not be used at all.

PHYLA

A. Arthropods

B. Chordates

C. Coelenterates

D. Echinoderms

E. Flat worms

F. Mollusca

G. Protozoa

H. Porifera

I. Round worms

J. Segmented worms

76. Flower-Like animals.....(....)

77. Soft bodied animals..... (....)

78. First jointed appendages...(....)

79. Single celled animals.....(....)

80. Worms with one body opening.(....)

81. Have a dorsal nerve cord...)....)

82. Have a water vascular system.(....)

83. First segmented bodies.....(....)

84. First many celled animals.....(....)

85. Have a chitinous exoskeleton..(....)

V DIRECTIONS: In the answer space after each description, write the letter showing which process is involved.

PROCESSES

(R) respiration (P) photosynthesis
(N) neither process

DESCRIPTIONS

86. Requires sunlight.....86.(....)
87. Gives off carbon dioxide...87.(....)
88. Enzyme action.....88.(....)
89. Uses water.....89.(....)
90. Involved in oxidation.....90.(....)
91. Produce like living forms..91.(....)
92. Stores energy.....92.(....)

A class in biology predicted that bacteria could be found on human hands. They tested this prediction by touching their fingers in the agar medium of a petri dish that had been heated. The dish was then placed in an incubator for two days.

Upon examining the dish, colonies of bacteria were found.

VI DIRECTIONS: On the basis of the above data, evaluate the following conclusions. In each answer space write (A) if you agree, (D) if you disagr-d, or (N) if the conclusion is not warranted because of insufficient data.

93. Bacteria are found on human hands.....93.(...)

94. Agar is the best medium for growing bacteria.....94.(...)

95. Bacteria are found in air.....95.(...)

96. A control dish which had not been exposed to hands should have been used.....96.(...)

97. Hands washed with soap are bacteria free..... 97.(...)

98. Bacteria were already present in the agar medium before the medium was touched.....98.(...)

99. Bacteria grow only under certain conditions.....99.(...)

100. No reliable conclusions can be drawn from the experiment 100.(...)

A solution of agar-agar is made, stoppered, and allowed to cool. It is not sterilized. Three days later, bacteria are noted growing beneath the surface of the agar. An inoculation is made from this culture into two sterilized agar slants. One inoculation on the surface of the agar, the other beneath the surface of the agar. After three days of incubation, the surface inoculation showed no bacteria, while the subsurface inoculation was growing nicely. This experiment was repeated six times, each time with the same results.

VII DIRECTIONS: Evaluate the following conclusions. Indicate agreement with an A. Indicate disagreement with a D. Indicate insufficient evidence with an N.

101. The bacteria we are dealing with here are anaerobes.....101.(...)

102. These bacteria are destroyed by the presence of light.....102.(...)

103. These bacteria are disease producing organisms.....103.(...)

104. These bacteria seem to grow in the absence of air.....104.(...)

105. These bacteria seem to thrive in the absence of feed.....105.(...)

106. The bacteria in the original culture were present in the agar solution when it was stoppered.....106.(...)

107. These bacteria would have gown faster if they had been heated to 80°F.....107.(...)

108. There seem to be no limiting factors connected with the growth of these bacteria...108.(...)

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