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ABSTRACT

A project developed, delivered, and evaluated a science inservice program for K-8 teachers of hearing impaired children. Twenty-five participants were selected for this project from a pool of 200 licensed hearing impaired teachers in the State of Indiana. The inservice program included a 5-day summer session and two follow-up workshops during the academic year. The summer session consisted of hands-on science activities, round table discussions, and lecture presentations focusing on using the learning cycle in the classroom. In addition, participants were engaged in activities that fostered critical thinking. The results of this project evidenced increased use of the learning cycle approach to content areas besides science, increased student motivation to take responsibility for their own learning, and an increased understanding of science concepts and ideas by the students. (Author)

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INTEGRATING SCIENCE INTO THE K-8 CURRICULUM OF DEAF CHILDREN

Final Report to the Indiana
Commission for Higher Education
August, 1991

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ABSTRACT

This project developed, delivered, and evaluated a science inservice program for K-8 teachers of hearing impaired children. Twenty-five participants were selected for this project from a pool of 200 licensed hearing impaired teachers in the State of Indiana.

The inservice program included a five-day summer session and two follow-up workshops during the academic year. The summer session consisted of hands-on science activities, round table discussions, and lecture presentations focusing on using the learning cycle in the classroom. In addition, participants were engaged in activities that fostered critical thinking.

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INDIANA COMMISSION FOR HIGHER EDUCATION
TITLE II/EISENHOWER PROJECTS

Final Project Report
Year Four (1988) Funding

1. Project Number: 89-COM-08

2. Sponsoring Institution: Indiana University School of Education at Indianapolis

3. Project Title: Integrating Science Into the K-8 Curriculum of Deaf Children

4. Project Directors: Charles R. Barman & Michael R. Cohen

5. Names, Addresses of Cooperating Institutions, Agencies, Foundations, etc., apart from Schools: None

6. Names, Addresses of Cooperating Schools: Indiana School for the Deaf, 1200 East 42nd Street, Indianapolis, IN 46205.

7. Type of Project: Individual

8. Grade Level Served: Elementary and Middle/Junior High

9. Subject Area: Science

10. Project Format: Institute and Follow-up Workshops

11. Major Activities: Instruction of teachers outside of class

12. College Credit for Participants: No

13. Number of public school corporations served: 7
    Number of public schools served: Approximately 20

14. Number of private schools served: 0

15. Number of teachers participating: 21

16. Average number of contact hours per participating teacher: 42

17. Number of students participating: 0

18. Number of students indirectly affected: 500. There are approximately 700 hearing impaired students in the State of Indiana, 365 of these are enrolled at the Indiana School for the Deaf. Teachers from six other school districts that have special classes for the hearing impaired participated in the program. It was estimated that teachers in these six school corporations would reach about 150 of the remaining students.

19. Number of non-teacher, non-student participants: 1. One of the participants was an education student who was preparing to be a teacher of the deaf.

20. Characteristics of participants:

    0 Native American
    0 Asian/Pacific Islander
    0 Black
    21 White
    0 Hispanic
    0 Unknown

    19 Female
    2 Male

    0 Currently teaching mathematics
    0 Currently teaching science
    21 Currently teaching math and science
    0 None of above

21. Project staff/instructors:

    3 Faculty from School of Education
    0 Faculty from Math, Science or related Departments
    3 School Teachers
    0 Non-local Faculty
    1 Graduate Students
    12 Other (6 presenters/coordinators & 6 deaf interpreters)

22. Sources of Funding:

Federal Title II/Eisenhower)	$49,460
Federal (Other)	$ -0-
Non-Federal (In Kind)	$ 6,164

23. Project Cost:

Total Project Budget	$55,624
Total Federal (Title II) Expenditures	$
Total Other Expenditures (Matching Funds)	$

24. Project Site: Indiana School for the Deaf, Indianapolis

25. Dates of Project Activities: June 18-22, 1990; October 26, 1990; March 15, 1991

26. Areas Served:

_X_ Urban
_X_ Suburban
_X_ Rural
_X_ Regional
_X_ Statewide

Narrative Report

27. Recruitment

In October of 1989 the Indiana School for the Deaf sent a letter of inquiry to all of the certified teachers of the hearing impaired in the State of Indiana. The purpose of this letter was to determine whether these teachers would be interested in participating in a science inservice program. Within a few days, 20% of these teachers responded to say that they would be interested in such a program.

With approval of the grant from the Indiana Commission on Higher Education, letters of invitation to participate in the program were sent to all certified teachers of hearing impaired children in the State of Indiana. From these applicants, eleven teachers were selected from the faculty at the Indiana School for the Deaf and ten from other school districts around the State. Altogether, a total of seven school districts were represented. (There are 47 school districts in the State of Indiana that provide special instruction for the hearing impaired.)

All of the participants in the program were teachers of the deaf and were selected on the basis of their experiences. School corporations of the participants cooperated in releasing their teachers for the two follow-up meetings during this past school year (1990-1991). Because the questionnaire and program information were distributed through a network of teachers of the deaf, the program attracted the kinds of persons who not only had a particular interest in it, but who also met the criteria for participation.

28. Cooperative Planning:

The project was a joint endeavor between faculty from the School of Education at Indiana University-Purdue University at Indianapolis (IUPUI) and the faculty and administrators from the Indiana School for the Deaf (ISD). The planning resulted from a series of discussions between the faculty and administrators of these two institutions. These discussions identified a concern for the lack of training in content areas for teachers of the deaf as well as a teaching strategy that could accommodate these needs.

29. Plan of Operation:

A. The five day workshops were held June 18-22, 1990, on the campus of the Indiana School for the Deaf. Twenty-one teachers and one pre-service teacher participated in the workshops (Appendix A). The program for the workshops focused on using the learning cycle and activities to develop learning skills. Participants conducted and analyzed science activities using the learning cycle. Presently available science materials such as Project Learning Tree were also shared. In addition, Laurie Christy from the Indianapolis Zoo provided training in Project Wild. A field trip to Crown Hill Cemetery was conducted to study how history and science can be integrated into the curriculum. Critical thinking and problem analysis skills were introduced through brain teasers and problem solving activities. Teachers were assigned to develop science lessons that followed the learning cycle format.

The follow up workshops (Appendix B) centered on sharing additional activities and discussions related to the implementation of the learning cycle in the classroom.

B. The evaluation suggests that the project had a positive impact on the participants. On the two written evaluations that the participants completed, they addressed how they utilized the materials and how these new efforts impacted upon their students' learning. The lessons and accompanying student assessments that the participants were required to complete and to turn in to the project director document the teachers' application of the learning cycle and their assessment of the students' learning of the science concepts from those specific lessons. The description of the project evaluation addresses the impact of the project in more detail.

C. Since there were no teachers from private schools involved in this project, it was not possible to ascertain nor address their specific needs.

D. The main purpose of this project was to help teachers of learning impaired students develop specific teaching strategies in the content area of science. See other parts of this report for details on implementation and evaluation.

E. Since this project was not developed specifically to address the needs of the gifted and talented, there is no way to assess its effectiveness on those students.

F. This project was developed for teachers of underserved/ underrepresented students--specifically the deaf. On the final project evaluation, the participants were asked to write about the advantages of the project for them as teachers of the

hearing impaired. They wrote that the learning cycle was particularly helpful for teaching the hearing impaired. Advantages that they cited include:

- the ability to use the learning cycle with students at multiple academic and reading levels,
- the visual, hands-on approach for the hearing impaired, and
- the students' assumption of responsibility for their own learning.

Additionally, the project was designed to involve both public school and residential school teachers of the hearing impaired. The result of this effort, as noted by the participants, was to establish a valuable network of teachers of the hearing impaired, a collegial resource that this special population does not have within individual school districts.

30. Evaluation:

The evaluation process of this project included four different phases. Each participant was sent an information sheet to be completed prior to the workshops in June, 1990. Toward the end of the summer, participants were also asked to complete an evaluation of these workshops. During the 1990-1991 school year each participant was asked to prepare and to teach two different science lessons demonstrating the learning cycle. The participants were required to forward the lessons to the project director along with comments as to how the students responded to the lessons. The final phase of this evaluation process was a written overall evaluation that participants completed in May, 1991.

Before the workshops began in June, 1990, each participant was sent an information sheet (Appendix C) to be completed and returned on the first day of the workshops. The intent of this sheet was to attain a baseline of information about the participants; their science background, interest in teaching science, and expectations of the project.

Of the 21 participants, ten were in public schools, two of these ten worked in special services, and eleven were teachers at the Indiana school for the Deaf. The majority of teachers (62%) had earned a master's degree. As to their collegiate preparation in science, the teachers had completed a diverse number of courses in science. Three (14%) had taken zero or one course in science during their undergraduate education. Eight (38%) had taken two or three courses, while nine (43%) had taken four or more courses in science. (One participant did not respond to this question.) Only four of the 21 participants had taken any graduate work in science; three had one or two courses and one teacher had taken over five graduate courses in science.

Only a small number (four) of the participants ranked teaching science as very important. Ten placed science in the top three subjects that they taught. When asked to describe their science teaching, the majority characterized it as an activity-oriented teaching process. Nine participants specifically referred to their science teaching as "hands-on." Other terms used to describe their science teaching included "practically-oriented," "inquiry," "process-oriented." When asked to describe the students' interest in science, the vast majority of participants wrote that the students were very interested in science. Six teachers noted that students enjoyed science, especially the experiments. Four teachers pointed out that students liked science because it was a hands-on subject. Two used the term "motivated" to describe the students' interest in science. Two noted students' interest as "very good."

Specific to this project, the participants were asked three different questions. First, they were asked why they volunteered to participate. Repeatedly, their responses centered around the need and/or interest to learn how to teach science differently. The teachers were interested in learning how to make science fun, interesting. Teachers wrote about wanting new ideas about teaching hearing impaired students. As to their expectations of the project, nine specifically noted expectations of new ideas, five wrote about learning to make science fun and enjoyable, three referred to learning specific hands-on techniques. Additional expectations included learning how to approach different topics and learning how to teach science with a practical focus. Lastly, the teachers were asked to describe the ideal inservice. Ten noted that the ideal inservice would include large amounts of hands-on activities. The other characteristics and activities suggested by the participants included "motivational, to inspire 'non-scientists' to find new ways to teach," "collaborative creation of a unit," "(ways) to develop and reinforce (students') conceptual understanding," and "doing experiments directly related to the (science) curriculum."

In analyzing the initial information provided by the participants, it was evident that their background, attitudes about science, and expectations of the project were in keeping with its design and objectives. The majority of participants had earned master's degrees and 43% of them had taken four of more undergraduate science courses. While few of the participants ranked science as very important among the subjects they taught, most of them described their science teaching as an active, thinking, hands-on effort. Furthermore, the majority of participants recognized that the students held an interest in science relate to the activity-oriented approach to the subject. Thus, it appears that the participants were academically prepared for the project and that they shared several fundamental concepts about the teaching of science upon

which the project was designed. The participants' expectations of the project were in line with its design and activities.

Approximately six weeks after the June workshops the participants were sent a workshop evaluation (Appendix D). The assessment included four questions. The participants were asked to 1) describe the strengths of the workshops, 2) identify what they learned from the workshops that they plan to incorporate into their teaching, 3) describe the workshops' weaknesses, and 4) identify what they wish had been covered in the workshops.

Eighteen (86%) completed evaluations were returned. Overall, the participants rated the workshops positively. Their comments suggested that they learned a great deal and that they were excited about incorporating these new strategies into their science teaching. The specific strengths of the workshops cited most often were the materials and the facilitators. The information about the learning cycle, in addition to the lessons and resource materials were considered valuable. The participants noted that the facilitators were thorough, easy to understand and worked well as a team, complementing each other and engendering motivation and enthusiasm about the topic. Other facets of the workshops cited as strengths were the hands-on activities, the sharing of ideas among other teachers of the hearing impaired, and the format of the worshops--modeling the learning cycle.

Eleven of the respondents (61%) reported that they planned to incorporate the learning cycle into their teaching. Others noted their plans included specific activities and strategies discussed in the workshops, for example activity-type lessons, science and language classes, and creative writing.

With respect to their dislikes or the weaknesses of the workshops, seven (39%) wrote that there were none. Five (28%) stated that the workshops were too short for the amount of material covered.

The respondents provided a variety of individual suggestions as to what the workshops might have included. Several of the ideas related to the concern note above that the workshops were too short for the amount of material discussed. These ideas included a need for more opportunities to write lesson plans, more time to discuss specific resources introduced, more ideas for exploration and application phases, more time on the use of the learning cycle with reading and language arts, more assessment information and more group work. Other suggestions were topics that individuals would like to have had covered, such as more physical science and chemistry and environmental issues.

The third form of assessment conducted with this project

involved a review of two different sets of lessons that the participants wrote, presented to their students, and shared with the project director. The participants were asked to bring one lesson along with their assessment of the students' learning of the associated material to the October, 1990, and March, 1991, follow-up meetings. The project director reviewed each set of lessons as to their inclusion of the three phases of the learning cycle.

In the first set of lessons, 16 of 19 lessons received (84%) included all three phases. Of the second set 15 of 19 (79%) incorporated all three learning cycle phases. In both the teachers' documentation of the students' learning and the teachers' discussion at the meeting, it was evident that the majority of students learned and were able to apply the concept(s) presented in the learning cycle lessons. The teachers elaborated on the merits of the learning cycle strategy and shared examples of their students' learning and growth using the learning cycle. Due to the diversity in the lessons, the assessment methods that the individual teachers used, and the individuality of the student body with which each teacher was working, it is not possible to summarize in more detail the students' learning. Examples of what the teachers presented are included in (Appendix E). Furthermore, the project design did not provide the opportunity for direct comparison of students' learning of science concepts using the learning cycle strategy versus the more traditional, text-oriented teaching strategy.

The last element of the project evaluation was a final written evaluation that was sent to all the participants in May, 1991. Eleven (52%) completed evaluations were received. This summative included five questions which addressed the participants' overall attitude about the program, the specific activities from the program they have applied to their science teaching, the changes they have observed in their students' attitudes toward science, and the merits of the program for them as teachers of the hearing impaired. A Copy of the final evaluation is attached (Appendix F).

Overall, the participants rated the program highly. They wrote of the program using such terms as "excellent," "terrific," "fantastic." Specifically, the participants emphasized three characteristics of this project as its strengths. Noted most often was the introduction and practice with hands-on activities. Additionally, the participants wrote highly of the opportunity to work with their colleagues. The positive dynamics of the group, the network established, the enthusiasm, and the discussion they had over the course of the year were highlights of the program. Third, the participants noted specific elements of the program, such as the trips they took, the resources shared with them, and the initial activity of the project, as items that they most liked about the

program. As to what the participants liked least, the items noted were a variety of individual concerns. For example, the secondary teachers wanted more information for teaching at the middle school and high school levels. Other comments focused on a desire for more different activities to use with students.

The respondents all wrote that they have applied phases of the learning cycle to their teaching. The majority of them have applied the teaching strategy in science, while several noted they had applied it in other subject areas. Specific applications of the project's materials that the teachers noted that they had used in the classroom included the following:

- exploration activities (2),
- pre-assessment of students' knowledge/concept understanding (4),
- permitting students to lead the direction of lessons (3),
- specific resources shared during the project.

As to changes that the teachers had observed in their students' attitudes toward science, the respondents wrote very positively. To summarize their comments, the teachers believed that the students enjoyed science and were enthusiastic about it. The teachers believed that the students were learning more and had better attitudes toward learning. Listed below are the range of phrases that the respondents wrote to communications:

- students became responsible for their own learning;
- students were more apt to try new things;
- students were more motivated;
- students were more relaxed with science, they became more confident;
- students retained more information; and
- students were more observant.

Finally, the participants listed the advantages and disadvantages of this project for them as teachers of the hearing impaired. The advantages noted most often centered around perceived improvements in the students' learning. Four wrote that the learning cycle encourages students to assume responsibility for their learning, and the teachers wrote that they were willing to let the student do that. Two respondents noted that the students became critical thinkers and were applying what they had learned. Two wrote that the learning cycle emphasizes conceptual development, a solid base for students' learning. Another set of advantages of the project note addressed the teachers. Three wrote that the project materials make science more fun to teach. Two pointed out that the interaction and network for hearing impaired teachers were positive features of the project.

The disadvantages of the project materials centered around the implementation of the learning cycle in the participants' teaching situations. Five noted the time constraints of their

schedule to allow for the set-up and student exploration time required with the learning cycle. Two noted difficulties in having to integrate their teaching with mainstream teachers. Two wrote of their own limitations in their repertoire and creative development of activities.

To summarize, the results of the evaluation suggest that the project met its objectives and was a positive experience for the participants and their students. The teachers documented, both in the lessons they wrote for the project director and in the self-reports in the final evaluation, that they had learned how to apply the learning cycle to their science teaching and indeed did apply it. Furthermore, the teachers documented that the students did learn from their participation in science learning cycle lessons. The teachers' reports on the final evaluation suggest that the students gained more than the learning of specific science concepts but also acquired a joy in learning science and assumed a more active role in their learning and application of science concepts.

31. Dissemination:

The results of the project were shared with teachers of the deaf in Indiana and special education directors from local education agencies. Dr. Lee Murphy, Superintendent of the Indiana School for the Deaf, attended the Annual Midwest Superintendents Conference in October, 1990, and shared information about the grant with other superintendents. They subsequently have signed a letter of support (Appendix G). The superintendents also requested more information on the project, as well as copies of the resource handbook that will be completed as a result of a follow-up project to this grant.

Three of the staff at the Indiana School for the Deaf attended the National Convention of American Instructors of the Deaf in New Orleans in June 1991. Information about the project was shared at this meeting with teachers and administrators from all over the United States and Canada.

A follow-up grant is providing for the compilation of a handbook on the findings of this project. This handbook will be used as instructional material for four regional workshops that will be held throughout Indiana during the summer of 1991 for teachers of the hearing impaired.

32. Lessons Learned:

A number of important lessons have been learned from this project. First of all, it has been highly beneficial to have teachers from public schools and the residential school working

together. These teachers established a valuable collegial network not available to teachers of the learning impaired in individual school districts. The project and the subsequent network has resulted in the sharing of concerns and ideas particular to the teaching of the hearing impaired.

During a follow-up discussion with some of the teachers, a number of benefits of the program became apparent. The teachers talked about how they were using the learning cycle not only for their science lessons, but for other content areas as well, and that as a result of using this methodology, their approach to education was changing. Students were becoming more motivated to learn. In the past students saw the teacher's role as one of directing the learning. After students experienced the learning cycle approach, they were more interested in learning on their own. Students would go to the library voluntarily. They would bring in science problems or events that they experienced at home, and pursued science topics on their own rather than waiting for the teacher's direction.

As a result of this student change in attitude, teachers were more willing to let go of their authority. They expressed the feeling that it felt good to not have to be in total control all of the time. Their role in the classroom became more that of a facilitator rather than a director. This in turn increased student motivation.

The teachers remarked that they felt that the learning cycle technique enabled the students to develop a better understanding of the the science concepts. Students seemed to have better retention of the concepts, and to globally integrate what they had learned with other concepts and ideas. In particular, the exploration phase enabled students to learn more in the same amount of time that would normally be spent learning from a text.

The exploration phase of the learning cycle also proved useful as an assessment tool. Semantic organizers and concept mapping were used to ascertain the students' ideas, words and concepts of a particular topic. From these teachers could organize their instruction to address the students' real needs. The exploration phase also served as an assessment tool to document the change in learning that took place for the student. This was not only beneficial for the student, but for the parents as well.

The teachers also gained from the experience. The teachers exuded a feeling of greater confidence and assurance. They felt that they were really doing something for their students. Teachers also changed their philosophy of education in that they began to look at resources in a different way. No longer did texts serve as the ultimate guide to learning, but as one of many valuable resources that enhance learning.

APPENDIX A

Integrating Science Into the K-8 Curriculum of Deaf Children

Summer Workshop - June 18-22, 1990

Alumni Room -ISD

<u>Monday, June 18</u>

9:00 - 10:00	-Introduction & Overview
10:00 - 10:15	-Break
10:45 - 12:00	-"Tree Doctor" Activity Introduced (Discuss the information and skills needed to perform this activity; also discuss what information and skills needed to conduct activity) -Conduct Activity -Analyze Activity -Review Project Learning Tree materials
12:00 - 1:00	-Lunch
1:00 - 2:30	-Discussion of Children's Science Concepts
2:30 - 3:30	-Science Topic Selection
3:30 - 4:00	-Brain Teasers

Tuesday, June 19

9:00 - 9:30	-"Interaction Game" - This will be a follow-up to Monday's Brain Teasers
9:30 - 10:30	-In groups of 3 (8 groups) discuss the skills and qualities of: (1) students, (2) teachers, (3) problem solvers, and (4) scientists
10:30 - 11:30	-Introduce Learning Cycle Approach
11:30 - 1:00	-Travel to Indianapolis Zoo/Lunch
1:00 - 4:00	-Project Wild (Facilitator - Laurie Christe) Rooms D & E - Education Center
7:00 pm	-optional informal gathering at Mary Glenn's home

Wednesday, June 20

9:00 - 10:30	-Integrating Language Arts and Science
12:00 - 1:00	-Lunch
1:00 - 4:00	-Lesson Development and Assessment

Thursday, June 21

9:00 - 9:30	-Paper Clip Activity
9:30 - 10:30	-Continuation of Work on Lessons; Assesment
10:30 - 10:45	-Break
10:45 - 12:00	-Assessment
12:00 - 1:00	-Lunch
1:00 - 4:00	-Field Trip to Crown Hill Cemetery (meet with Wayne Sanford)

Friday, June 22

9:00 - 10:45	-Dr. Seuss (Oobleck and Lorax)
10:45 - 11:00	-Break
11:00 - 12:00	-Conclusion and Plans for Fall & Spring Meetings
12:00 - ?	-Lunch and Awards Ceremony

APPENDIX B

Fall Follow-up Meeting
October 26, 1990

I. Whirlybird Lesson (Demonstrate the Learning Cycle)

A. Discuss the whirlybird lesson

II. Tree Activity

A. Find adopted tree from last summer.

Break

III. Evaluation Discussion

IV. Critical Thinking Activities

A. Think Tubes & Push Rod Boxes

B. Mike's famous "egg trick"

C. Ghost in the bottle

Participant Assignment: Expand on original lesson to develop 1 or more additional learning cycles.

Spring Follow-up Meeting
April 15, 1991

I. Review the learning cycle lessons the participants developed.

A. Discuss the experiences the participants had developing and teacing the learning cycle lessons.

II. Workshop Presentation "SAVI-SELPH Science Materials for Handicapped Children" (Workshop Facilitator - Barbara Provus)

III. Final Wrap-up

APPENDIX C

INTEGRATING SCIENCE INTO THE K-8 CURRICULUM OF DEAF CHILDREN

INITIAL PARTICIPANT INFORMATION SHEET
JUNE 18, 1990

NAME _____

SCHOOL _____

Please answer the following questions. Feel free to use additional paper to respond to any one of the questions completely.

EDUCATION

1. Please list the degrees which you have earned.

College/University	Major	Degree	Year Earned

2. List the courses or the approximate number of hours you have taken in science and/or science education. Include all your undergraduate coursework and graduate work.

Undergraduate. _____

_____

_____

_____

_____

Graduate. _____

_____

_____

_____

_____

SCIENCE INTEREST

3. Where would you rank science in comparison with the other subjects you teach? Why?

4. How would you characterize your science teaching? Please explain your answer or give examples to illustrate your characterization.

5. How would your describe your students' interest in science? Please explain your answer.

PROJECT EXPECTATIONS

6. Why did you volunteer to participate in this project? What caught your eye about this project?

7. What are your expectations of the project? What do you hope to learn?

8. Describe the "ideal" science inservice program for you.

APPENDIX D

INTEGRATING SCIENCE INTO THE K-8 CURRICULUM OF DEAF CHILDREN

PARTICIPANT EVALUATION
JUNE, 1990

NAME _____

SCHOOL _____

Please answer the following questions about the summer science workshop in which you participated June 18 - 22, 1990. Please use the back of this sheet, if necessary, to provide your complete thoughts.

1. Describe the strengths of the workshop. What did you most like about the workshop? Please refer to specific activities and/or components of the workshop.

2. What did you learn from your participation in the workshop that you plan to incorporate into your teaching this year?

3. Describe what you disliked about the workshop. What were its weaknesses?

4. Now as your beginning your planning for the coming year, what do you wish had been covered or a part of the summer science workshop?

APPENDIX E

Curriculum Area: Science
Unit Title: Adopt-a-Tree
Grade Level: H.I. Upper Primary

Objective I Students will demonstrate an understanding of the basic parts of a tree. (bark, trunk, branches, leaves)

Process Skills:

Observation

c. Use instruments to aid the sense in making observations.

d. Make observations.

Communication

a. Describe observations verbally.

c. Record observations in a systematic way.

Formulating Models

a. Distinguish between models (drawings) and reality.

b. Construct a drawing including new observations

Materials: ① drawing paper, crayons, markers
② Map of the school and grounds
③ Camera and film
④ Tape measure
⑤ Magnifying glasses
⑥ Tree identification books

Pre-assessment Activity: Prior to any instructic or observation each student will draw a tree.

Exploration Phase:

1. Students and teachers will explore the school grounds and locate trees. The location of the trees will be marked on a map of the school and grounds
2. Using the map each child will locate the tree that they wish to adopt.
3. The student's picture will be taken with his/her tree and the location of his/her tree marked on a class map.
4. Each student will explore his/her tree and record information about the following observations.
   a. tell what color the wood part of the tree is
   b. tell if the wood is rough or smooth
   c. measure around the tree at a point which is 18 inches from the ground.
   d. what insects live on the tree
   e. what animals live in the tree
   f. are the branches pointing up, down or straight out.

5. The students will make rubbings of the bark and a leaf.

Vocabulary: Names of the trees,
bark (skin)
trunk (body)
branches (arms-legs)
leaves (hair)

Concept Introduction:

① Use books from the library to identify each child's tree.

② Compare the part's of a tree with the part's of a person's body.

Application:

1. Go outside and label the parts of the adopted tree

Post Assessment: The student's will draw a picture of their adopted tree and label it's parts. Compare with the Pre-assessment picture.

Student: _____

Unit: Science Adopt-a-Tree

Date: Sept 11, 1990 to

Assessment Activities	Date	Score
1. Pre-assessment activity draw a tree		
2. Locate their tree on a map of the building and grounds		
3. Label these parts of their tree bark trunk branches leaves		
4. Post-assessment activity draw their tree. Compare with pre-assessment picture.		

Teacher Observations:

Student: A [redacted] age 9 3rd grade Mild loss Hard of Hearing

Unit: Science Adopt-a-Tree

Date: Sept 11, 1990 to

Assessment Activities	Date	Score
1. Pre-assessment activity draw a tree	9.11.90	Apples Hole in tree Black lines on brown bark
2. Locate their tree on a map of the building and grounds	9.13.90	
3. Label these parts of their tree bark trunk branches leaves	9.28.90	+
4. Post-assessment activity draw their tree. Compare with pre-assessment picture.	10.5.90	label parts + Tree had leaves + branches + trunk + bark +

Teacher Observations:

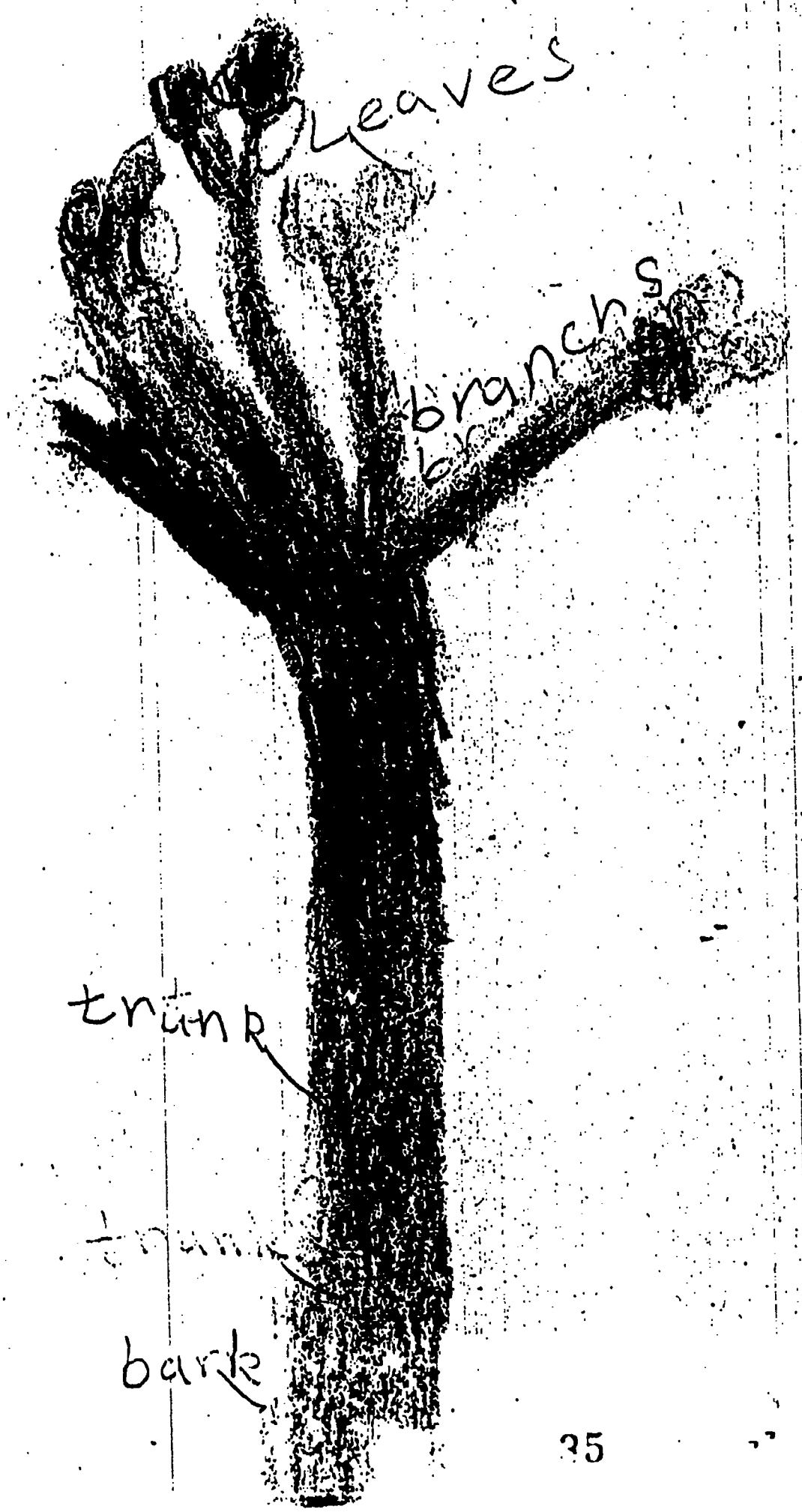
10.5.90 Looks alot like her tree long trunk, branches just on top leaves changing colors. Used library books to identify her tree as a Honey Locust

[redacted] 4.11.40

Student A Age 9 Pre-Assessment

[redacted] 10-15-70 [redacted]

Student A age 9 Post-Assessment



Student: B [redacted] age 9 3rd grade Deaf Profound loss

Unit: Science Adopt-a-Tree

Date: Sept 11, 1990 to

Assessment Activities	Date	Score
1. Pre-assessment activity draw a tree.	9.11.90	Apple Tree
2. Locate their tree on a map of the building and grounds	9.13.90	+
3. Label these parts of their tree bark trunk branches leaves	9.28.90	+
4. Post-assessment activity draw their tree. Compare with pre-assessment picture.	10.5.90	label parts + Tree had leaves + branches + trunk + bark - (all one color)

Teacher Observations:

9.11.90 When we went out to map tree locations we saw several sick + dying trees. One tree's bark was covered with oozing sap. Matthew asked if it had thrown up.

9.21.90 Told Bobby that the holes in his leaves were made by bugs

9.20.90 Saw an insect hole in Bobby's tree but no insect. Said it was inside the hole because it was raining outside

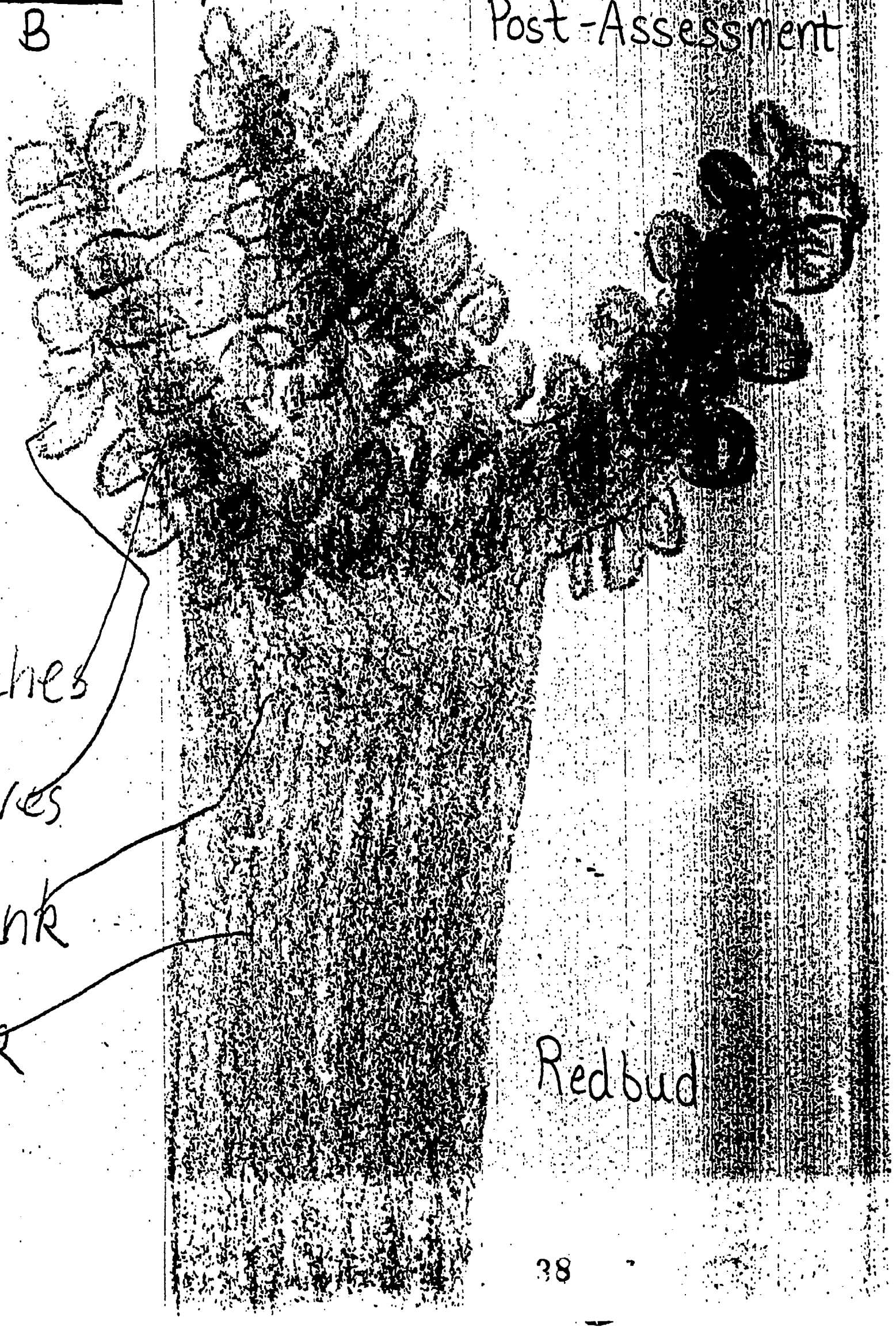
10.5.90 Ask if he could make his leaves green and yellow because they are changing.

Used library books to identify his tree. It is a Redbud.

[redacted] 10-5-90 [redacted]

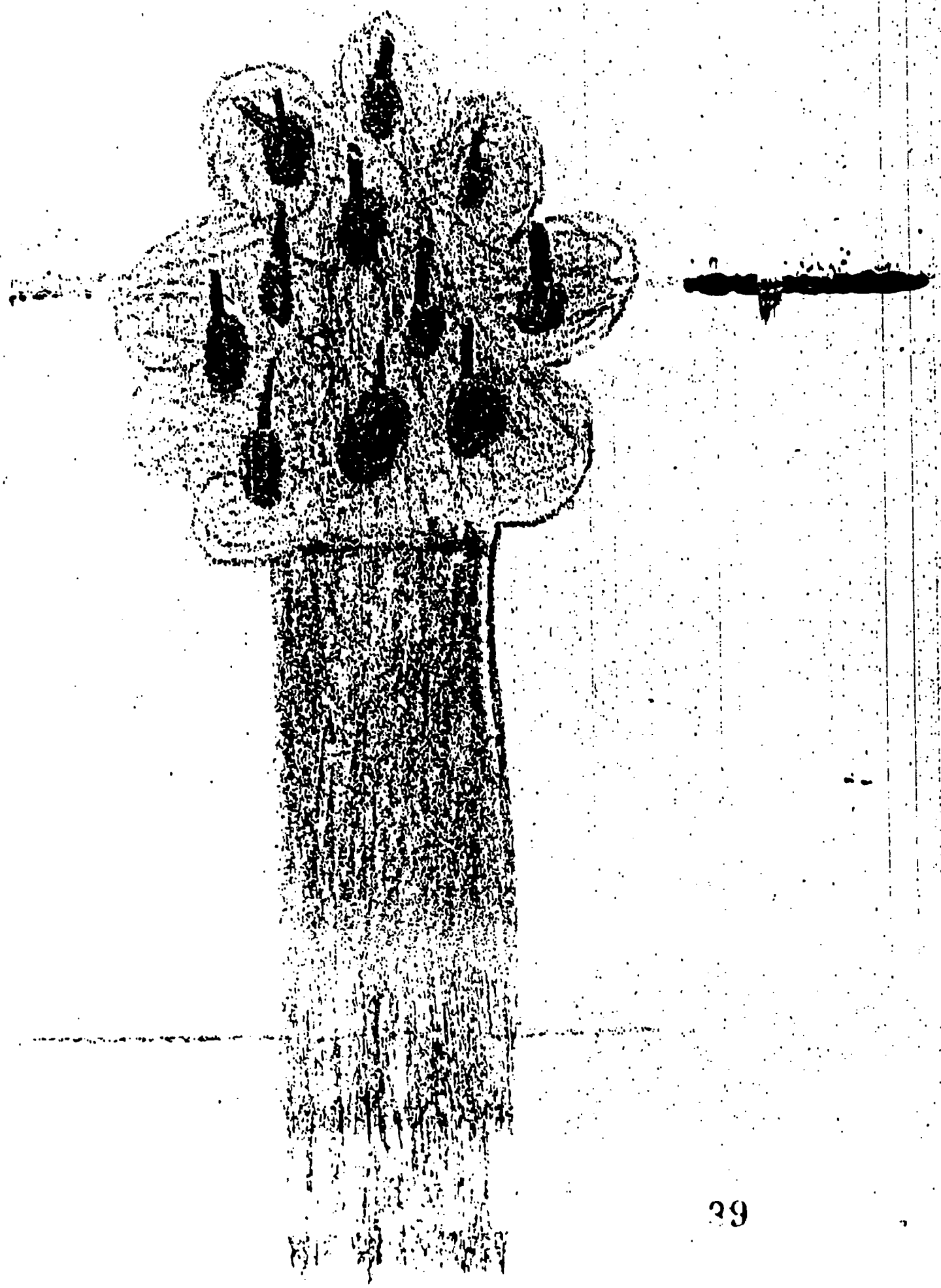
Student B

Post-Assessment



[redacted] 1-11-90 [redacted]

Student B age 9 Pre-Assessment



Student: C age 9 [redacted] 3rd grade

Moderate to Severe Hearing loss

Unit: Science Adopt-a-Tree

Date: Sept 11, 1990 to

Assessment Activities	Date	Score
1. Pre-assessment activity draw a tree	9.11.90	Fall colors in balloon
2. Locate their tree on a map of the building and grounds	9.13.90	+
3. Label these parts of their tree bark trunk branches leaves	9.28.90	+
4. Post-assessment activity draw their tree. Compare with pre-assessment picture.	10.5.90	labeled parts Tree had leaves branches trunk bark

Teacher Observations:

9.21.90 Asked why his leaves had holes in them?

10.5.90 Asked if he could make his leaves changing from green to yellow. Bark was white with black lines Used library books to help identify his tree as a Paper Birch

[redacted] 4-11-90 [redacted]

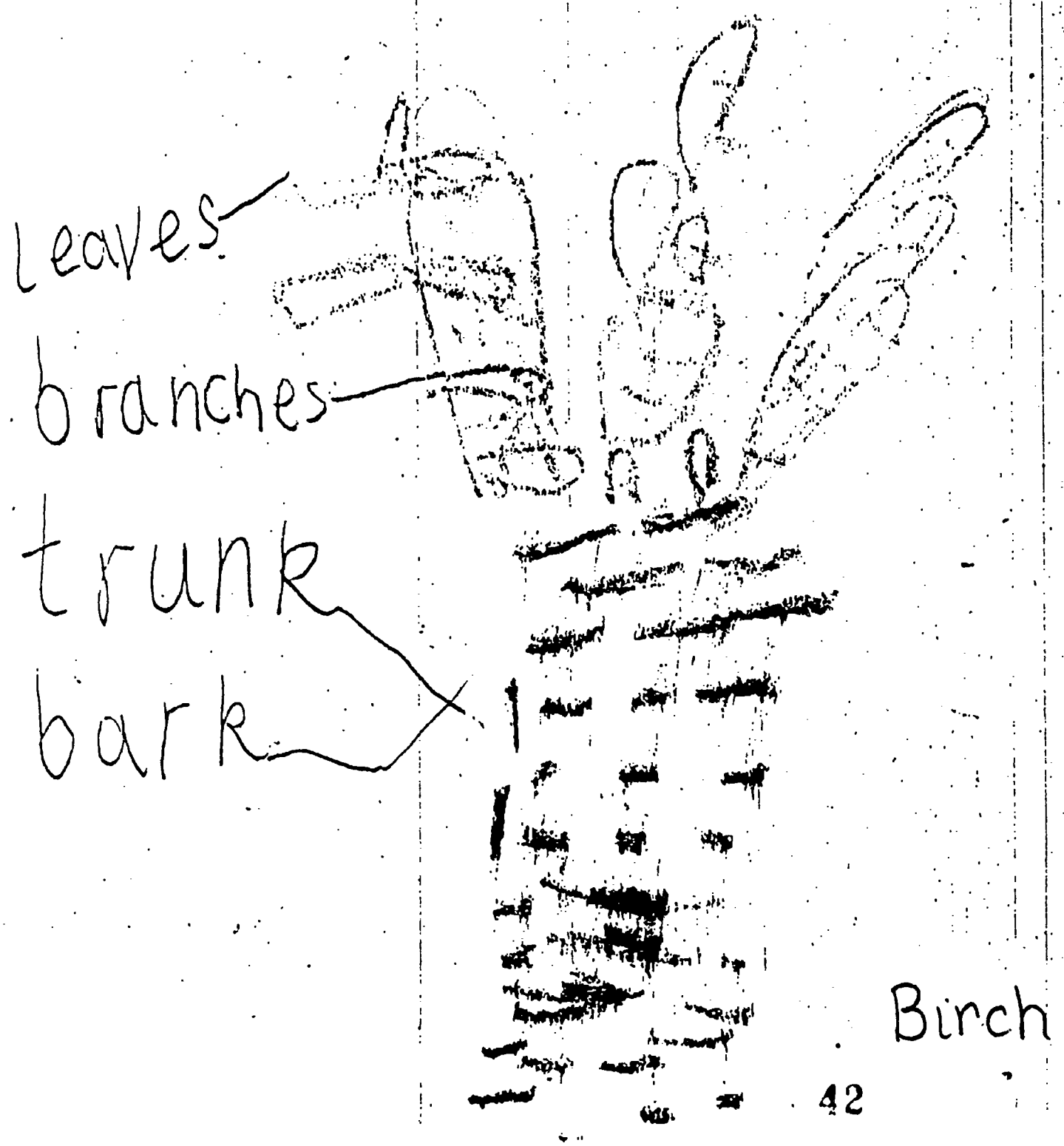
Student C

Pre-Assessment

[redacted] Post- Assessment [redacted] 5

Student C

10 5 90



Birch

Student D age 9 3rd grade Deaf severe to profoun hearing loss

Student: [redacted]
Unit: Science Adopt-a-Tree
Date: Sept 11, 1990 to

Assessment Activities	Date	Score
1. Pre-assessment activity draw a tree	9.11.90	
2. Locate their tree on a map of the building and grounds	9.13.90	+
3. Label these parts of their tree bark trunk branches leaves	9.28.90	+
4. Post-assessment activity draw their tree. Compare with pre-assessment picture.	10.5.90	labeled parts Tree had trunk + leaves + branches - bark +

Teacher Observations:
10.5.90 Made her bark multi-color like her tree made some of her leaves red like the leaves on her tree.
Used Library books to identify her tree as a Flowering Dogwood

[redacted] 9·11·90 [redacted]

Student D

Pre Assessment

[redacted] 10 5 90 [redacted]

Student D

Post Assessment

Flowering Dogwood

AIR PRESSURE LESSON

CLASS: 7A Science

OBJECTIVES:
(1) to learn air has pressure.
(2) to learn that air pressure is all around and can be measured even though it cannot be seen.

EXPLORATION

Guided and self descovery techniques were used during the lesson. Glasses, glass jars, tag, straws, balloons in sealed bottles, balloons, etc. were placed on a table.

Guided portions were: (1) students were to fill a glass full of water and find a way to hold the water in an upside down position with a tag card so the water did not fall out and (2) to blow up a balloon inside a sealed jar. Brainstorming occurred as to what was happening in each situation.

Individual exploration consisted of students trying to explore other ways that showed same idea (air pressure). They discovered (1) turning a jar upside down in water and water did not enter jar, (2) blowing air out of jar with straw and water entered, (3) removing seal from jar and balloon to inflate balloon, (4) sinking an inflated baloon in water, and (5) putting jar in water at an angle and emptying the jar with a straw.

CONCEPT INTRODUCTION

Discussion of text material on air pressure was held. Information was related to activities and possible results were discussed as a group. The effects of air pressure on weather was discussed.

CONCEPT APPLICATION

The students were asked to draw pictures of activities they did during exploration and to show where air pressure was in effect.

The students were asked to construct a "homemade" barometer to track air pressure using a direction paper. They were then to write an explanation of how the instrument worked and to compare the readings with those recorded in the following paragraph.

The students were asked to record air pressure daily for 7 days and explain the weather changes in relation to air pressure.

STUDENT RESPONSES--AIR PRESSURE

The activities in exploration were done as one group. There were leaders and followers. Three were leaders--coming up with ideas, and one was a follower with few original ideas. This occurs in most interactions of the group.

RESULTS

Julie Julie seemed to be able to understand well the concepts at each level. Responses to questioning during the exploration phase showed that she was able to come up with the idea that air was pushing on the card, on the water, and on the baloon. During the Introduction Phase, Julie was able to say, "Oh, yea. That's why the water didn't fall out of the jar," and proceded to explain where the air was pressuring. She completed the Application Phase with ease. Her explanation drawings were perfect. She was able to explain the working of the homemade barometer with ease.

Jarvis Jarvis was one of the leaders during Exploration. He came up with an idea or two to try and attempted to explain what was happening, although not accurately. He understood the information during Concept Introduction which led him to be able to understand better why some of his activities worked. His drawings during Application Phase were 90% correct and with help, he was able to explain those he did not understand at first. His weather charting was done well. He could explain how the homemade barometer worked.

Heather Heather tried to come up with ideas to try during Exploration. However, several ideas tested did not seem to work so she seemed to give up and follow the lead of Julie and Jarvis. She tried hard and was fascinated with the happenings of the activities. Her responses to teacher's questioning during this phase did not show much understanding as to why they worked. She is a good reader and thinker so things became better understood during the Concept Introduction Phase. When asked to do the drawings during concept application, Heather was 80% accurate. However, when Julie and Jarvis explained the ones she did not understand, she could easily change her drawings. Her weather charting and "barometer" explanation were well done.

Miki Miki was the follower during Exploration Phase. She had few new ideas but participated well with the others and they included her actively. Miki was unable to explain any ideas during questioning. During the Concept Introduction Phase, Miki was able to learn the information through discussion and with the other students giving her additional examples. In Concept Application, Miki scored 73% on her drawings. With addition instruction from students and teacher, Miki was able to correct her drawings. Her weather chartings were done well. With student help, she could describe how the "barometer" worked.

MAGNET LESSON

CLASS: 8D Science (slow--limited reading and language)

OBJECTIVES:
(1) to learn what magnets will and will not pick up.
(2) to learn that items picked up are made of iron and steel and items not picked up do not contain iron or steel.

EXPLORATION

Magnets of varying shapes were given to the students. On the table were placed 30 items--some containing iron or steel and some not containing iron or steel. Students were to locate the things that could be picked up with a magnet and put them in one pile. Those that could not be picked up were to be put in a second group. Students were questioned as to why items were placed in a specific group to get students to think "why". (Aside: During this phase, students also found that magnet placed beneath table would also move some objects but not others.)

CONCEPT INTRODUCTION

Discussion of magnets and attraction was held. Information was taught by teacher. Students learned reason things are attracted or not attracted--contain iron or steel.

CONCEPT APPLICATION

The students were to draw the items that magnets would or would not pick up. Under each they were to write "iron or steel" or "no iron or steel".

The students were to locate other items in the room magnets would attract and explain why attracted.

The students were to locate in dorm 10 items magnets would attract and 10 items magnets would not attract. They were to draw the pictures of the items and tell reason for attraction or non attraction.

This activity was intended to be done as a group activity. However, I quickly learned that they did not have group working skills. With my lead they would do some things as a group. But, as soon as I tried to pull out of the activity to make it fully exploration, the group disintegrated and became 3 individuals doing the same tasks.

RESULTS

Ben Ben actively participated in exploration and enjoyed it. He was able to separate items into two groups easily. He could only say "metal" when questioned why items were in the attracted group. When presented with aluminum foil and aluminum cans, you could visibly see doubt enter his face. He was then unsure as to why. During the exploration, he found that he could make some objects on the table move about when he placed a magnet under the table. He understood information presented during Concept Introduction. He was able to accomplish Application activities with ease.

Robert Robert loved the exploration activities. He could separate the items into two groups, but had no reason why the groups were significantly different. He found the magnet could make a chain of paper clips on end. He tried the same idea with other objects but they did not work as well. He was unable to explain reason for attraction or nonattraction. He understood information during discussion well. He completed tasks of Concept Application easily.

Adam Adam liked the Exploration activity. He was able to accomplish the task required. However, he did not test other ideas with the magnet. He restricted his activity only to the task suggested by the teacher. He could not answer any questions asked by the teacher during Exploration. He even through up his hands in frustration. During Concept Introduction, he had difficulty understanding cause for attraction or nonattraction. (He tends to give up easily.) Other students helped him and he finally understood the ideas. He was then able to do the tasks of Concept Application with 80% accuracy. With additional help and explanation, he was able to correct his errors.

Done with a class of 3 low functioning students

OBJECTIVE: Students will learn that gravity exists and that gravity pulls equally regardless of mass or height.

EXPLORATION

1. In room students were given a variety of objects to drop and throw in the air. The objects were of different weights and non-breakable. They were to drop them, throw them up in the air, throw them across the room, etc, and observe what happened to the objects. During this part of the activity, questions were asked of the students to get them to explain what was happening and to try to speculate why it was happening.

2. Students were to drop 2 items--at same time and same height--to determine what happened. (Parameters given: the students could stand on anything safe in room, i.e. box, chair, table, etc. to test observations.)

3. Same objects were dropped from second floor down stairwell to basement floor (2 stories) to test if height change made a difference in observations made in classroom.

EXPANSION

Discussion occurred about activities in exploration stage. We made a list of what we observed. Teacher used this time to teach concept of gravity, to teach needed vocabular, to relate to previously learned magnets concepts, to discuss mass and height, etc.

APPLICATION

1. Students were given new items and asked to create a chart showing results when any 2 selected items were dropped.

2. Students were to draw pictures showing how gravity affects our everyday lives, i.e. a skating boy falls, a girl drops her books, water goes down from a faucet, etc. They were also asked to draw pictures of the same items if gravity did not exist.

3. Students were shown pictures and asked to describe orally where gravity was working or what was affected by gravity.

STUDENT RESULTS

All students were very successful with each phase of the cycle.

ROBERT - Loved the activities in exploration phase, especially the third activity. It was great fun to run up and down the stairs and to judge when the objects hit the floor. He learned the concepts of gravity and the new vocabulary (spelling and use). His scores on all 3 application items was 87% or better. His drawings were hard to understand but he could explain the ideas well.

BEN - Ben, as usual, was the leader in the exploration phase at first. He jumps at the hands-on activities and carries the activity beyond the stated goal. He was trying many objects in the room not originally included in activities 1 and 2--testing his own ideas. He participated in discussion. Vocabulary learning is hard but concept learning was good. His application activities scored 85% or better. He drew good pictures and could explain what was happening in each.

ADAM - Adam always hangs back in activities. He did so in this lesson too. After trying one or two items in exploration, he wanted to sit and watch. Other boys pulled him into the activities. He especially liked and participated in dropping the items two stories. He learned the information taught in expansion but mostly by watching, not participating. His application work showed he had learned the concepts. He scored 90% on his work. His drawings were very creative, as usual.

Science: Living things need food.

Goals: Students will...
- demonstrate how plants produce their own food.
- demonstrate how plants and animals depend on eachother for food sources.
- Classify animals into the catagories of herbivores, carnivores and omnivores.
- draw up food chains and food webs.

Day One

Exploration

The kids answered almost all of the questions for the entire unit after the first exploration.

Cover the leaves of a plant with aluminum foil and set it in a sunny window.

Ask the students to generate a list of what a plant needs to grow;

- sunlight, air and water.

be sure that the plant recieves all of the above needs for a week and have the students predict what will happen to the plant, make a running list and leave it by the plant to make additions if need be.

Day two:
Concept introduction -

At the end of one week uncover the foiled leaves and check the results with the predictions.

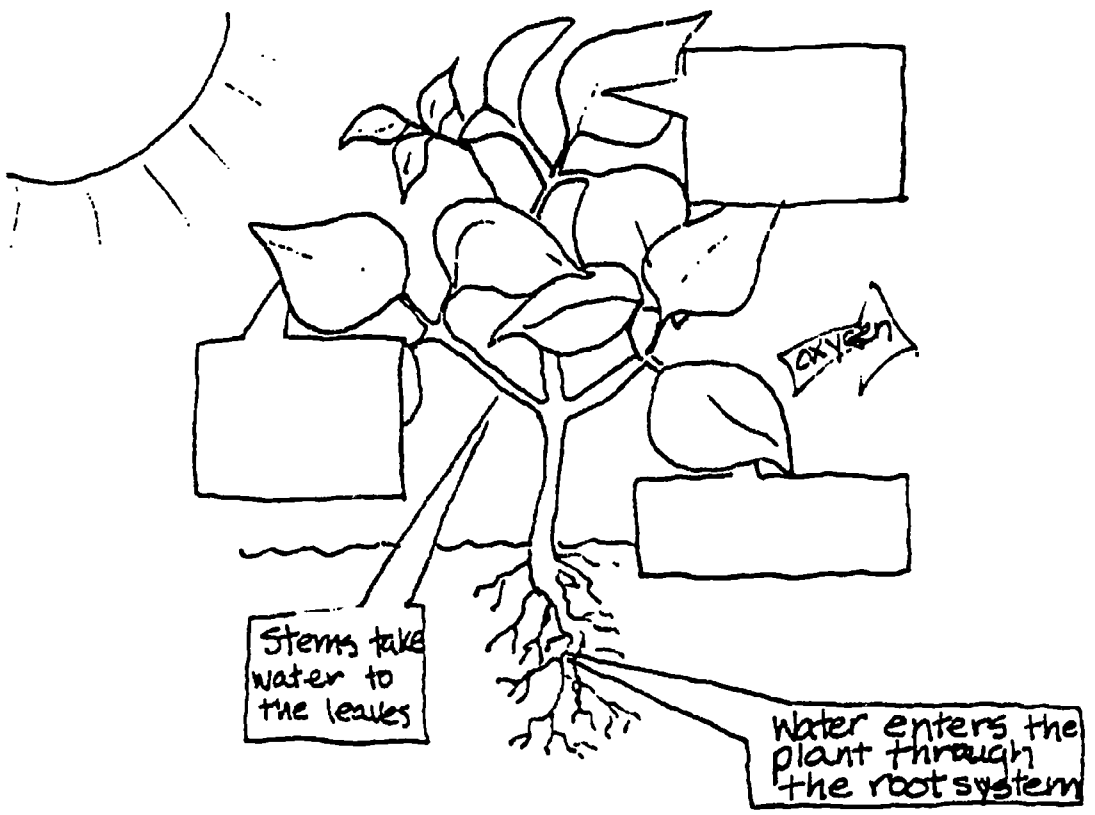
Ask -
- Why did the leaves die when they had sunlight, air and water?
- Why did the stem become soggy?
- Why aren't new leaves growing?
- What was denied from the leaves of the plant?

Record the answers.

If there were no sunlight what on earth would die?
expected answers - only plants.

<u>How plants make food</u>:

We already know that plants need air water and sunlight to live what we are going to learn is that plants make their own food and food for many animals too.



Review the parts of the plant and their functions.

roots — absorb water and minerals.
stems — water + minerals travel to the —
leaves —
flower —

Narrow in on leaves.
Focus

Look at the leaves; healthy, dying and dead through a microscope. and draw pictures of what they see in each.

A leaf that gets enough sun, air and water is like a factory.

There is a special green substance to a leaf that collects energy from the sun called Chlorophyl.

chlorophyl = saves sunlight
air (carbon dioxide) = leaf breathes in
— oxygen = leaves the leaf.
water & minerals = enter the leaf through the stem
+ _____
food = leaves make air, water, minerals and sunlight into food for itself and other animals.

a plant is a producer, it makes its own food and food for others.

Make a list of things from a plant that we can eat.
apples, grapes, carrots etc.

Assessment ~
Pair off students and have them as a team geneate some kind of a diagram or flow chart showing how plants make their own food.

They must include
plant parts and their functions,
carbon ~~monox~~ CO_2 dioxide, etc.

Lesson 2 Consumerism:
Exploration—

Have several different pictures of animals. Explain to the students that they already know how to classify animals according to physical characteristics (mammal, bird, reptiles, etc.) and environments and now we've got to figure out how to classify them in a different way.

Have all the students put their heads together and see if they can come up with a new way to classify animals.

If they don't, pull together a few pictures of herbivores, omnivores and carnivores and guide them in drawing the conclusion that certain animals can be put together by what they eat.

i.e. What do a tiger, an octopus and an eagle have in common?

Explain that like plants animals need food too!

Play the consumer game—

Have a variety of animals and plants that would be found in the same environment written out on

index cards. Have each student draw a card and guess what that animal would eat. (Have the students think back to the adaptions unit to teeth, claws, etc. to help them figure out the answer.)

Explain that they have now become the animals on the cards, and we are now going to play a game. In the game there are rules:

1. Plants can not move!
2. You can only eat what would really be in your diet as an animal!
3. All you have to do is touch what it is you need to eat for it to die!
4. Once you've been 'eaten' you are dead.
5. You must eat the amount of food written on the back of your card or you die!

Concept Introduction -

Have the students think back to the game.
How many kinds of "eaters" were there in the game?

- How do the animals' body parts effect their eating habits?
- What would die if there were no sunlight?

Record the answers to these questions.

Explain that all animals need to gather the food they need to survive. The act of gathering food is called <u>consumerism</u>.

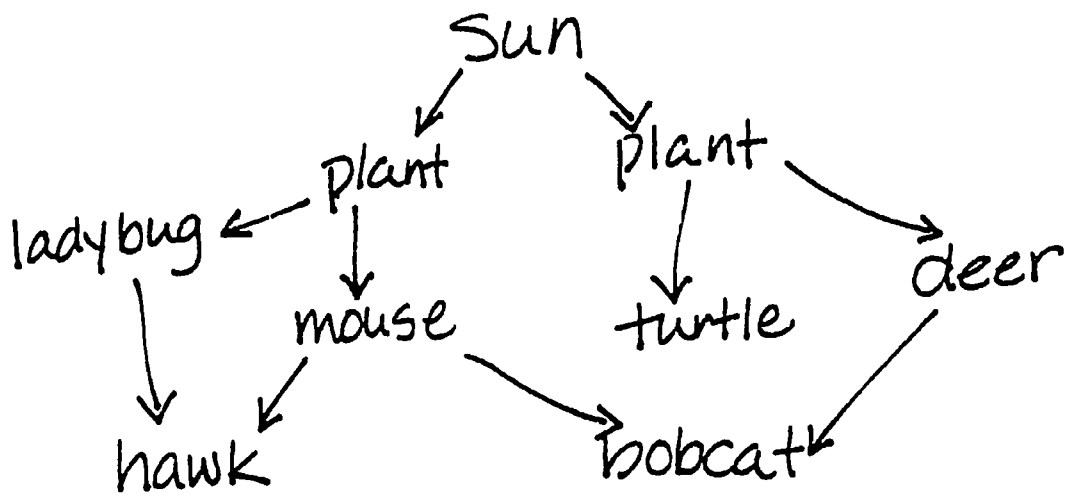
Label the classifications of the animals according to their eating habits.

Consumers:
- herbivores – animals eat only plants
- omnivores – animals that eat both plants and animals
- carnivores – animals that eat only other animals.

Set up several different animal groupings and arrange them in the order in which the would be eaten –

sun — plant — grasshopper — bird — cat

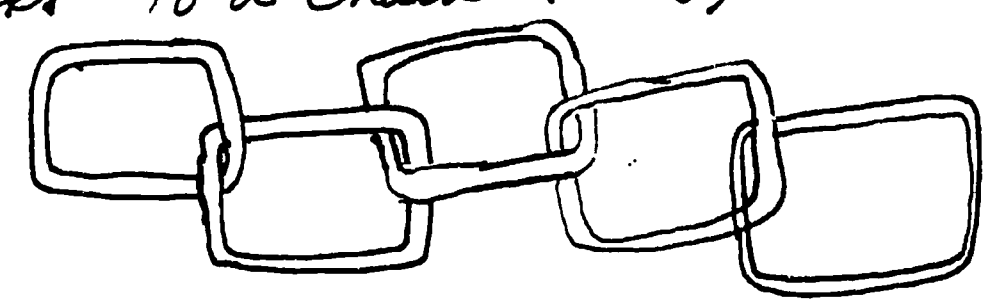
Food chain.



FOOD WEB

Assessment~

Supply each student with several links to a chain (6×8)



Have the students cut out pictures to generate the food chain—
They must label the pictures with:

Producer
Consumer
herbivore
carnivore
omnivore
energy source

remember the first step is always the energy source (sun).

Science: Living things need food.

+ excellent
✓ satisfactory
– lack of comprehension

	demonstrates how plants produce their own food.	recognizes related vocab and demonstrates comprehension thru usage.	photosyntesis, chlorophyl, producer	can classify animals according to their eating habits: consumer herbivore, Omnivore, carnivore	demonstrates how plants and animals depend on each other for survival. Food chains and webs	Comments:
Donna	✓	–	✓	✓		Donna showed a lack of motivation for this unit. She showed great comprehension of the concepts but the vocab was not there!
Jr	✓+	✓	+	✓+		Jr. demonstrate understanding through discussion and work. Vocab was dificult but he got it!
Dulrycia	✓+	✓–	✓+	✓+		The vocabulary really gave Dulrycia the struggle but in arranging pictures she was right on target.
John	✓+	✓	+	+		All it took was the exploration phase for John to get going - only the vocab had to be "taught".
Ben	✓+	✓+	+	+		Ben breezed through it all! He was on the top of the concepts and the vocab.
Tony	✓	✓–	✓+	✓+		The only thing Tony struggled with was the vocabulary in the plant section

Ben

APPENDIX F

INTEGRATING SCIENCE INTO THE K-8 CURRICULUM OF DEAF CHILDREN

PARTICIPANT FINAL EVALUATION

NAME _____ SCHOOL _____

Please answer the following questions about the science workshop series in which you participated June 1990, October, 1990 and March 1991. Please use additional paper, if necessary, to provide your complete thoughts.

1. Describe your overall attitude towards the inservice program. What did you most like about the different program activities and workshops? Please refer to specific activities and/or components of the program.

2. What did you least like about the inservice program? Again, please refer to specific activities and/or components of the program.

3. What have you applied to your science teaching this past year that you learned from your participation in this program? Please indicate those activities and/or materials that were new to your teaching this year.

OVER

4. What changes have you experienced in your students' attitudes toward science and their science learning as a result of the teaching applications you listed above?

5. Please describe the specific advantages and disadvantages of the program to you as a teacher of the hearing impaired.

Thank you for taking the time to complete this final evaluation. Your comments will be helpful to us. I hope that you have a splendid, relaxing summer!!

Please return the completed evaluation in the enclosed envelope <u>no later than Friday, May 31st</u>.

APPENDIX G

MISSOURI SCHOOL FOR THE DEAF

OFFICE OF THE SUPERINTENDENT

505 EAST FIFTH STREET • FULTON, MISSOURI 65251-1799 • (314) 642-3301 VOICE/TDD

November 1, 1990

Dr. Lee Murphy
Superintendent
Indiana School for the Deaf
4200 E. 42 Street
Indianapolis, Indiana 46205

Dear Dr. Murphy:

Thank you for sharing information about the Indiana Commission for Higher Education Eisenhower Mathematics and Science Education inservice program for training both residential and public school teachers of deaf children.

We understand the grant focused on the development, dissemination, and evaluation of science activities for deaf children. We are interested in the results of last summer's (1990) workshop which included 25 teachers working with several consultants from Indiana University.

Typically, teachers of the deaf do not have adequate (sometimes none) training in the teaching of the sciences. This inservice training is invaluable at this time in the education of the deaf.

Please continue sharing information on this program. If your cooperative proposal with Indiana University is funded for 1991, please share the materials with us.

Accredited by the North Central Association of Colleges and Schools and The Conference of Educational Administrators Serving the Deaf.

We will include the project in our regional workshops and network with the Indiana School for the Deaf in disseminating information on the teaching of science to deaf children.

We support your efforts in this area of development.

Sincerely,

Superintendent, Missouri School for the Deaf

Superintendent, Minnesota School for the Deaf

Superintendent, Kansas School for the Deaf

Superintendent, Wisconsin School for the Deaf

Superintendent, Nebraska School for the Deaf

Superintendent, Illinois School for the Deaf

END

U.S. Dept. of Education

Office of Educational
Research and Improvement (OERI)

ERIC

Date Filmed
August 9, 1992