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ABSTRACT

This booklet, the second in a series, reports on the results of a year-long research project conducted in an experimental school associated with the Learning Research and Development Center, University of Pittsburgh. Specifically, this is a report of findings pertaining to one major setting in the experimental school, the science lab. The science lab setting is first described from the vantage point of a participant observer. Attention is paid to the lab as it is used by intermediate grade pupils. Pupils' beliefs about the science lab are then presented and discussed. The aim is to show how pupils react to the planned science curriculum. Finally, the results of a behavior observation scale study are reported which show how pupils act on their beliefs about the science lab. (Author/DMT)

# LEARNING RESEARCH AND DEVELOPMENT CENTER

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## THE BELIEFS AND BEHAVIORS OF PUPILS IN AN EXPERIMENTAL SCHOOL: THE SCIENCE LAB

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# Abstract

This paper, the second in a series, reports on the results of a year-long research project conducted in an experimental school associated with the Learning Research and Development Center, University of Pittsburgh. Specifically, this is a report of findings pertaining to one major setting in the experimental school, the science lab. The science lab setting is first described from the vantage point of a participant observer. Attention is paid to the lab as it is used by intermediate grade pupils. Pupils' beliefs about the science lab are then presented and discussed. The aim is to show how pupils react to the planned science curriculum. Finally, the results of a behavior observation scale study are reported which show how pupils act on their beliefs about the science lab.

# THE BELIEFS AND BEHAVIORS OF PUPILS IN AN EXPERIMENTAL SCHOOL: THE SCIENCE LAB

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> In science we get to experiment with a lot of different stuff.
> . . . A Pupil

This is the second in a series of reports on a school I have called Longbranch. Longbranch is an experimental (or developmental) elementary school which has had a 10-year association with the Learning Research and Development Center at the University of Pittsburgh. As an anthropologist and participant observer, I conducted a year-long study of the beliefs and behaviors of intermediate-grade pupils in the school.

Several different techniques were employed in the study, including clinical examination interviews with selected pupils, a similarities judgment instrument completed by all pupils, and a pupil behavior observation scale.[1]

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[1] The rationale and design for the study, as well as details on the methods employed, can be found in Lancy (1976).

The overall aims were to describe the school life of fourth and fifth graders, to elicit and validate their shared cognitive map of this school life, and to study their behavior patterns in light of this map.

One important feature of school life which has an impact on pupils' beliefs and behaviors is something I have called setting. There is a variety of different settings in Longbranch, and these are distinguished by their location in the school building and/or by the type of curriculum plans carried out in them by adult actors. As an experimental school, Longbranch displays a wide range of such plans, including courses that are individualized, self-managed, modular, or more traditional. There are many adult actors who must carry out and monitor these curriculum plans, including regular teachers, special teachers, instructional aides, program developers, program implementors, researchers, and a principal.

This report describes one such setting, the science lab. The science lab is housed in a large trailer located just behind the main building. The science curriculum in use is *Individualized Science* (IS). Like the math, reading, spelling and learning skills curricula at Longbranch, IS can be contrasted with more traditional curricula in that instruction is matched to the abilities, prior knowledge, and learning pace of each pupil. Hence, the science lab setting is characterized by a particular plan (IS)[2] operating in a particular place (the lab trailer).

The science lab setting will be described as part of the school life of fourth and fifth graders. From November 1974 to June 1975, I spent an average of two hours per week as a participant observer in the science lab, and the description is based on extensive field-notes taken during that time. I will also present the results of several studies designed to show how these pupils view the lab, particularly how they define and classify their own activities there. This classification of activities was used in an observation study of pupils in the lab. Data on the frequency of the various activities, the extent to which pupils work in groups, and pupils' locations in the lab are reported.

## The Science Lab

In addition to the obvious facts of its physical location and unique curriculum plan, I have singled out the science lab for intensive scrutiny for two reasons. First, during a year's participant observation in Longbranch, approximately one-third of my time was spent in the science lab, and I have, consequently, much more data from that setting than from any other in the school. Second, as the principal subjects of my study

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[2] It is important to point out that once a curriculum has been developed, it goes through a process of implementation as it is incorporated into the schools. Thus, the curriculum in operation may be somewhat different from the curriculum as originally designed. This may be true in the case of IS in use in the Longbranch science lab.

were pupils, and because they conveyed to me by word and action that the science lab was one of their favorite settings, it was appropriate that I treat it as a special case.[3]

Generally, the science lab setting is conceived of as two settings. All the pupils (17-25 in number) from a single homeroom came to the science lab once a week for a 45-minute science class. At various other times during the week, individuals could leave their homeroom and visit the lab as a "self-selected" activity. Pupils could make a number of such visits per week and spend as much time in the lab as their homeroom teacher permitted. However, the science teacher required that each child spend 30 minutes of this self-selected time working in the curriculum. Once this obligation had been fulfilled, they were free to play, make things, and devise their own experiments. As a result, the lab looked rather different during class time and self-selected time. By the end of the project, however, I was persuaded that the class/self-selected dichotomy was not that clear. ~~Hence, my dis~~cussion will treat the lab as a single setting, with only occasional remarks and results to bring out the contrasts between class-time and self-selected time that seem important to retain.

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[3] Another reason for focusing on the science lab was that I participated in a seminar at LRDC which brought together various center research associates so that they might focus at least part of their research effort on the evaluation of the individualized science curriculum. This multidisciplinary project is described in Leinhardt (1975).

Figure 1 is a physical map of the science lab. Behaviorally, the room can be divided into carrels, where pupils work in relative isolation and quiet; there are large round tables and table benches, where noiser, more active group activities take place; there are storage areas running along either wall, where pupils get the materials they need; there is an animal corner; and there is a kind of play area which includes the teacher's desk, the shelf with games and toys, and the floor space in between.

Present in the lab at all times are a science teacher (male) and an aide (female). The only time that the teacher addresses the class as a whole is to ask for less noise; otherwise, he interacts entirely with single pupils or pairs of pupils working jointly on an assignment. The teacher may initiate such contacts, but the aide is "on call" by pupils or the teacher to answer questions or get materials. She also does a good deal of the straightening-up and record-keeping. Both teacher and aide are warm and supportive of pupils. The teacher seems to be "on top of" the curriculum in the sense that he is rarely at a loss in guiding and helping pupils who are having difficulty.

The curriculum is apportioned into *levels*. There are six levels, and children progress from lower to higher levels. Each succeeding level increases in difficulty and, to a certain extent, builds on knowledge acquired in preceding levels. The fourth and fifth graders were distributed over Levels C to E, with the majority in C and D. Each level contains from

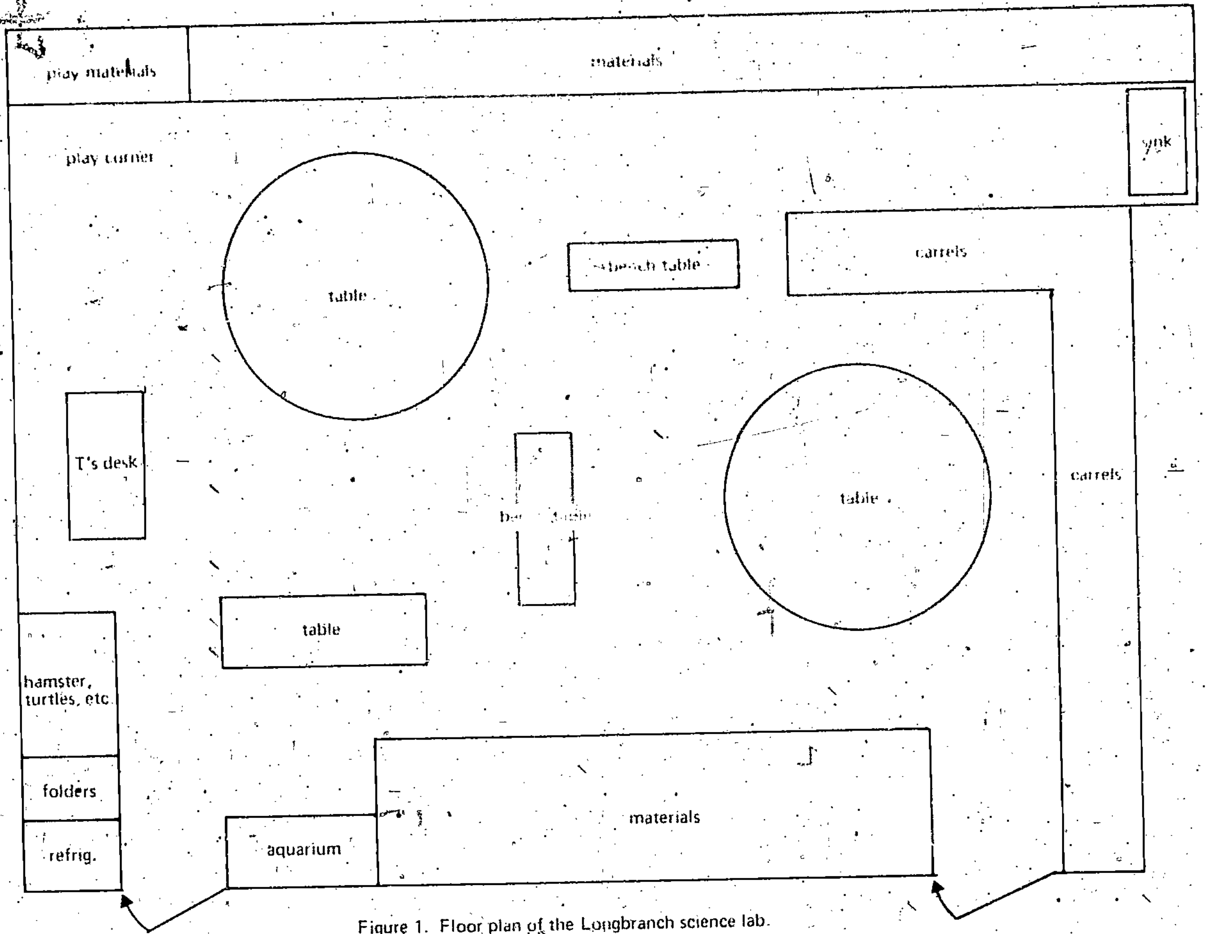

Figure 1. Floor plan of the Longbranch science lab.

three to six *units*, each of which is named for a famous scientist (i.e., Vesalius, Volta) and focuses on a scientific principle or set of principles (i.e., systems, electricity). During the term of my study, intermediate grade pupils completed an average of three units. As a pupil works in a unit, he may choose among a variety of *learning resources*. These resources vary along a number of dimensions; the developers' aim is to provide "the option of using a variety of instructional strategies to teach the same behavior or concept" (Champagne & Klopfer, 1974, p. 140).

There are five kinds of learning resources used with great frequency by the intermediate pupil. They are: *Lessons*, *Mini-Ex's* (miniature explorations), *RIS's* (readings in science), *SA's* (student activities), and *SIIA's* (self-initiated independent activities). (*ITE's* [invitations to explore] are not used often but are mentioned later in this discussion.) Resources vary along at least two dimensions. They vary in terms of a reading *versus* manipulation requirement. In some, the pupil will spend most of his time reading; in others, more time will be spent in actually carrying out an investigation. They also vary in the extent to which specific directions are given to pupils and the extent to which specific, as opposed to more global or thought-provoking, questions are asked of pupils.

Levels, units, and learning resources are put together as follows. Assume that a pupil has completed all the units in Level C and is now ready for Level D. The pupil may choose among four units in Level D to begin working in. The teacher may steer a pupil away from a given unit because it is too difficult or because there are already several students in that unit, placing a strain on the limited materials available; otherwise, it is the pupil's choice. Assume the pupil has chosen to work in the Dalton unit (atoms and molecules). First, he will get a planning sheet for this unit. Planning sheets have a series of squares which the pupil, in consultation with the teacher, fills in with the codes designating some sample of the many available learning resources for Dalton. The plan will contain some mixture of MinEx's, SA's, RIS's, Lessons, and so forth. The pupil will then begin work by reading and answering the questions in an introductory lesson booklet. After that, he is free to carry out the other parts of the plan in any order he chooses. At the beginning of each class, he will consult his plan, choose a resource from it (i.e., Dalton SA-7), get the appropriate booklet and the associated materials, and complete the resource. When he is finished, he consults with the teacher who questions him to determine his level of understanding. If the teacher is satisfied, the square is crossed off and the child is free to go on to the next resource. If the teacher feels the pupil has learned the concepts from several such resources, he suggests that the pupil may be ready for a posttest. If the pupil masters the posttest, he may then choose among three other units in Level D. When he has completed a total of three units in Level D, he may go on to Level E.

In theory, the number of discrete pathways through the IS curriculum approaches infinity. In practice, however, there are pressures to reduce this diversity. First, the teacher implicitly imposes a limit by requiring that pupils complete a minimum number of resources before the posttest can be taken. (There is, however, pupil pressure to impose an upper limit on this number.) Second, there is considerable pupil pressure to limit the range of learning resources in which they engage. I observed that certain of the learning resources were very heavily used and others were never used. When I asked the science teacher about this, he stated that students gravitate toward learning resources that involve the manipulation of materials and avoid those that require either a great deal of initiative or any amount of reading to carry them through.

## Pupil's Classification of Science Lab Activities

Several pupils were interviewed at length about "the kinds of things kids do in science." The interviews were recorded, transcribed, and content-analyzed. The interviews were designed to elicit the pupil's terms for the various activities and the relationships among activities. Hence, I would frequently ask a very general question like, "What are the different things kids do when they are in science?" In each subsequent interview, I would also ask some questions designed to discover whether the present interviewee saw the same activities occurring in the science lab as previously interviewed pupils.

D.L.: Tommy, I'm going to ask you a series of questions about the different kind of things that kids do when they're in school. So what we'll do is, I'll ask you about different places in the school. Let's start with science. What are the different things kids do when they're in Science?

Tommy: We make experiments for our self-selected. We just do our unit. And for our self-selected we mix stuff.

D.L.: What else do you do?

Tommy: Nothing else. That's all I do.

D.L.: That's all you do?

Tommy: Yeah.

D.L.: Let's say you're in your unit. What are the different things you do in your unit?

Tommy: Well, you just get the lesson and you do it.

D.L.: Is it just lessons? What else do you do besides lessons?

Tommy: MinEx's and SA's, that's all.

D.L.: What else do you do in Science?

Tommy: Nothing.

D.L.: Do you play in Science?

Tommy: Yeah.

D.L.: What do you play with?

Tommy: They have games up there like Mouse Trap.

D.L.: What else?

Tommy: That's all.

D.L. What about playing with the animals?

Tommy Oh yeah, we play with the hamster, we look at the fish.

For example, Tommy was the fifth pupil interviewed. Other pupils had claimed to "play in science,"[1] so I asked him about this. From the interview with Tommy, we learn that pupils "do" Lessons, MinEx's, and SA's. They also "play games" (i e , "mouse trap") and they "play with animals" (i.e , play with the hamster and look at fish). Fifteen such interviews with fourth and fifth graders of both sexes yielded sufficient data to construct the taxonomy of activities shown in Figure 2. In addition to eliciting terms and their relationships, I also sought pupils' definitions of these terms. For example, I asked them in interviews what the phrase "bugging someone" meant. I also got information on the meaning of activity terms by observing a child doing something, then asking the child directly, "What are you doing now?" (Henceforth, when I use a term like "making" or "working" or "fooling around," I will use it with the meaning that it has for pupils.)

Each activity category and subcategory will be used as an organizing rubric for describing the school life of the science lab To illustrate the working category, I have

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[1] Henceforth, whenever I first use a term or phrase which was elicited or overheard from a pupil it will be placed in quotation marks.

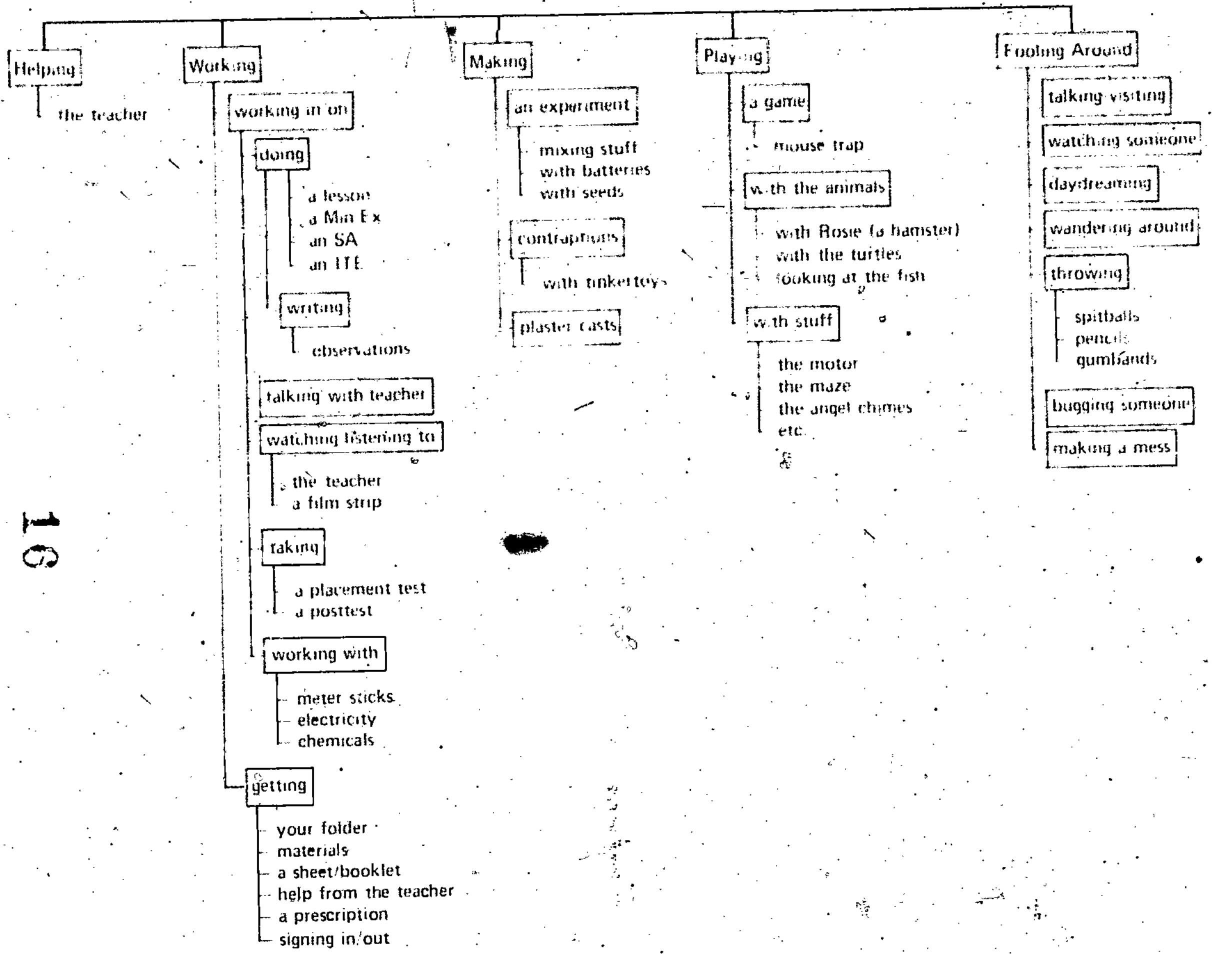

Figure 2. Taxonomy of pupil-named activities for the science lab.

chosen an episode from my notes that, in many respects, is typical. Two fifth-grade girls, Karen and Barbara, are "working in Volta." Both have worked on learning resources together, and by now they have completed several of them. Karen and Barbara are both good students. They are conscientious, get good grades, and are well-behaved. They are seated together at a table, both reading from an ITE booklet.

Barbara: (reading aloud) You can make a homemade light bulb that works. (She goes over to the shelf and brings back the indicated materials.)

Barbara (to teacher) It says you need a pencil switch; what's a pencil switch? (He shows her how to make one.)

Barbara What's an ITE anyway, Karen? (This question unanswered, they continue to read.)

Barbara: Are you done with it already?

Karen: Yeah.

Barbara: Good, then you can do this with me. (They write on a clean page of their notebooks: ITE Investigation A.)

Karen: What is this ITE?

Barbara: Electric circuits. (The girls begin to make the light bulb. They are having some trouble with wire strippers.)

Karen: We'll never be strong enough.

Barbara: Because we're girls, maybe with women's lib_.

Karen: We'll never get done with this. (They follow the assembly directions which are punctuated by questions. They write answers in their notebooks.)

Karen: Hey Barbara, you know what? I think it was supposed to light up. We did it wrong.

Barbara: I think we have a dead bulb.

Karen: I think we have a dead battery.

Karen: (to teacher) Is this a dead bulb?

Teacher: It shouldn't be. (The girls write up their observations, noting down exactly what they did.)

Barbara: I like Volta (the unit).

Karen: So do I, but we can't get anything to work. (They had, in fact, not reached the objectives in the two investigations they have worked on in the preceding two weeks.)

Barbara: Do we have music next?

Karen: Yeah, I think so.

(The girls put away their materials and folders and move close to the door and sit quietly until it's time to "line up" and leave.)

By referring to Figure 2, we can confirm that these two girls are "working" throughout this episode. They are "doing an ITE," or "working with electricity." At one point, Barbara "gets materials" from the shelf; and, later, they both "write observations" in their notebooks. The episode also reveals that there is a sequence to all these working activities. Ideally, the sequence will look like this:

1. Get folder from file cabinet (getting).
2. Get out plan (or chart) and decide what resource to work on (getting).
3. Get appropriate resource booklet from the rack (getting).
4. Read it (doing).

5. Get materials indicated (getting).

6. Follow directions for manipulating materials while answering questions (doing).

7. Write up observations and/or answer questions (writing).

8. Correct from key and/or conference with teacher (talking with teacher).

9. Put away materials, etc. (getting).

Karen and Barbara follow this sequence very closely, which is not always the case. More often, the sequence is rearranged or interrupted. Another episode will reveal some of these interruptions. Again, there are two fifth-grade girls who are good students and who regularly work as a pair. The two girls are doing an SA in Beaumont (which they started in the last class). The SA is a crossword puzzle. The clues are questions on the digestive system.

| | |
|---|---|
| Pam: | 31 down, waste or leftover. |
| Sharon: | I already got that one. |
| Pam: | What is it? |
| Sharon: | Scrap. |
| Another girl: | Are you still on Beaumont? Pam, you're never going to get out of that one. |
| Pam: | 27 across, when water evaporates it changes from a liquid to a gas. |
| Sharon: | Which one was that? |
| Pam: | 27 across. O.K., your turn. |
| Sharon: | 16 down. Read it. I don't know what it is. |

Pam: I don't know either.

(Sharon starts to draw a fish on a blank space on her booklet. Pam traces over the letters in Beaumont. Then they discuss Christmas presents [date = 11/26].)

Pam: We put everybody's name in a hat; that way we can buy bigger presents. (They watch two boys making molecules out of colored balls and sticks.)

Pam: I'm never going to pass this.

Sharon: I got another one. I get all the answers and you just copy them down. (This is indeed what has been happening.)

(Pam gets up and goes to the teacher.)

Pam: (shows him the SA) Mr. ____, we can't get this one.

Mr. ____: Come back to it later. (She stops to tease a boy before returning to her seat.)

Sharon: What's 13 down, molecules of chemical substances move through a membrane by this process?

Pam: Oh, Sharon, we had that in the MinEx where we work with honey.

Sharon: Get it.

Pam. You get it.

Sharon: No, I'm the one getting all the answers.

(Pam leaves to get the MinEx on honey and membranes. Enroute, she stops to "watch the fish" for awhile before she gets it. The teacher has told them to put their things away. The girls do so. They will continue "doing the SA" next time.)

The sequence does not end with a conference with the teacher, nor do the girls finish the SA. Their minds wander, and when they leave their seats to get things, they find interesting things to look at or people to talk to. This takes place in class time where the norm is working. As we see, however, Pam and Sharon engage in some fooling around and making. These activities, plus playing, occur in class time only as a break in the normal work plan. When a child is in the lab on self-selected time, he or she may spend the entire visit making or playing.

The diversity of materials in the science lab is utilized by children on self-selected visits in making various "concoctions." Boys use the tinkertoys to make "contraptions," "airplanes," "monsters," and so on. All of the children, but especially the fourth graders, enjoyed making casts on their fingers with plaster-of-paris. Virtually every child had made at least one "plaster cast," and some had made them on as many as 10 separate occasions. The making of plaster-fingers began in October and peaked in February, with some children still making them at the end of the year. Their skill in making them gradually improved, and variations (dying the plaster with food coloring) were introduced. Children also made casts of shells and coins with plaster-of-paris and clay. Batteries, switches, and light bulbs formed the building blocks as pupils made lengthy electrical circuits. The object was, like building a block tower, to see how long you could make the circuit and still get the bulb to light.

"Making an experiment" involves a certain degree of restraint not present in these more free-form making activities.

The curriculum designates this activity as an SIIA, or self-initiated independent activity. Pupils fill in a sheet that asks them to list the materials they use, the amounts of each, what they do with the materials, and what the results are. In an interview, Sally, a fourth-grade girl, had this to say:

| | |
|---|---|
| Sally: | Well, sometimes I make an experiment. Like my girlfriend and I once made an experiment. We put 1/3 dixie cup of lemon juice and sugar in it and we stirred it and then we put it in the freezer. |
| D.L.: | And what happened? |
| Sally: | Then in three days we came back and it was frozen. |

This is a description of a fairly typical "mixture," and mixtures are the most common experiments. Girls seem to prefer mixtures that "turn out nice." When there was snow on the ground, a frequent activity was collecting a beaker full of snow and then adding various food color dyes until a pleasing effect had been achieved. Boys prefer making mixtures that either look or smell "awful." They delight in pouring unlikely materials (baking soda, honey, soap powder) together and then heating the whole thing until it boils. They also seem to relish in heating things, in general, because they get to wear asbestos aprons, gloves, and goggles. A mixture-making episode is excerpted below to illustrate the phenomenon.

(Three fourth-grade boys are in the lab on self-selected time; they are planning an SIIA.)

Bobby: I'm not going to write it for everybody; get your own, Frankie. (At this point, it is not clear whether all three will be together or in some other combination.)

Frankie: How about food coloring?

Jim: (writes and says) Yeast, 10 milimeters (sic) of water and red food coloring.

Frankie: I'll get the snow. Oh, oh, there's not enough snow.

Jim: We need ammonia.

Bobby: Are youns gonna heat it?

Jim: No, freeze it.

Bobby: Yeast, that's yucky stuff.

Frankie: Mr. ____, we're done (filling out sheet). We need you to sign the sheet.

Mr. ____: O.K., put down that you're going to freeze it.

(Later)

Jim: No, Frankie, that's only a half; get a big spoonful. It looks like blood; it looks like a baby's diapers.

Frankie: It's bleedin.

A girl: Yeah, I bet you put red food coloring in.

Bobby: Jim, that's neat.

Jim: Another one of my super-duper experiments. (He stirs the mixture in the beaker, then transfers it into a smaller beaker, spilling half of it.)

(Frankie starts to leave, but Jim drags him back.)

Jim: (to Frankie) It's your yuck, too. (Frankie carries beaker to the freezer.)

(Bobby, meanwhile, has also made a mixture and is heating it on a hot plate.)

Aide: Bobby, what did you make today?

Bobby: (laughs) Chocolate milk.

Aide: No one would drink that.

Bobby: I wish someone was dumb enough to.

Although making occurs in self-selected time, children greatly enjoy work that bears a resemblance to making. I overheard one girl say, "SA 51's so neat; you use paste and it turns purple." Many SA's and MinEx's lead to dramatic transformations in color, temperature, or matter. The principal distinction between doing a MinEx and making a mixture was expressed by several pupils as follows: "When you make an experiment on self-selected, you can mix anything you want; when you do a MinEx, you have to follow what's on the sheet."

There are several educational games in the lab (SLG, science learning games) but these are used rarely. Instead, there are a few play objects in the lab that get very heavy use. There is a game called Mouse-Trap. It is a commercial game and consists of a complex series of Rube Goldberg devices. When assembled, a marble placed at one end of the series makes its tortuous way around until it drops on a balance beam and shoots a plastic man into a pool of water and drops a trap over a square on the board. If the player's mouse is on the square, it is trapped and the player is eliminated. Actually, I never saw pupils play the game, or even fully assemble it. Rather, they played with parts of it, particularly the part with the man and the pool.

Before she died in April, Rosie the hamster was a favorite playmate of the children. They built pens for her out of rulers and masking tape, carried her around in their pockets, talked to her, dressed her up, and so on. Two box turtles in residence were played with less often, and fish in an aquarium attracted some attention. Various other objects were available for play, including a battery-run motor, a plastic maze puzzle filled with mercury, "angel chimes," magnets, and so on. Other pieces of lab equipment were played with from time to time.

One of the more interesting types of play occurred in the course of carrying out a MinEx, SA, or other investigation. Investigations often called for the use of unusual (for pupils) equipment. It was frequently the case that pupils would get sidetracked into playing with the equipment. A large plastic syringe is used in one MinEx, for example, to force air into a solution. Pupils sometimes failed to finish this particular investigation because they got involved in exploring and playing with the syringe. Other materials which consistently evoked a play response were: honey, stethoscope, balloons, "gumbands," a buzzer, test tubes and rack, and food coloring.

Finally, parts of some investigations were extracted by pupils and repeated over and over. These included, for example, a sequence where electric current is passed through steel wool fibers to make a light bulb, the use of phenolphthalein to "change colors," and "invisible" writing on paper. Moreover, when one pupil begins playing with materials or parts of an investigation, he is quickly joined by others who watch or join in. Here, we turn to the last important activity category--fooling around.

There are a number of activities which pupils classify as "fooling around." In talking with them, three attributes of fooling around are paramount. First, fooling around is "not working when you are supposed to be working." Hence, an activity that might be making or playing in self-selected time is fooling around if it occurs during class time. Second, fooling around is "not allowed." Most types of fooling around are ignored by the teacher, but some, such as "throwing" and "making a mess," attract his attention and earn a reprimand. Finally, fooling around often means "you are bugging someone," or preventing them from doing their work. When Sharon and Pam draw pictures, watch the two boys, and talk about Christmas presents in the above episode, they are "fooling around" because they are not doing their work. When Pam stops to tease a boy, she is "bugging him."

[illegible] observed one episode that illustrates several types of fooling around. A fifth-grade girl is doing Beaumont MinEx-6, which requires the use of honey. As she gets her materials together, a boy "steals" the honey, squirts some on his finger, and then eats it. This attracts considerable attention, but the children obviously understand hygiene because several of the six additional pupils who take honey in the ensuing half-hour pour it onto tongue depressors and lick it off of this. The pupils "bug" the girl by taking the honey she needs for her MinEx. They are not working, but are instead talking and joking among themselves about honey and sweet things. They stick each other with honey and use the tongue depressors as darts ("throwing"). Meanwhile, almost all the other pupils in the room not involved with the honey fracas "watch" it taking place.

Situations in which the whole class fooled around were not uncommon, although the honey episode lasted for almost the entire period, which is rare. These incidents were inevitably sparked off when a pupil, in the course of working in a unit, began doing an investigation which was novel for the whole class. For example, two boys began to dissect a frog in a Harvey MinEx, and this captured the attention of the whole class, as did other projects involving a water siphon, a student-constructed device to measure blood pressure, and so on.

To conclude this section, my lasting impression of the Science Lab is of an atmosphere of movement and excitement on the part of pupils at all times. Although the various activities are semantically discreet, they blend together behaviorally much like a "mixture," with the outcome being just as unpredictable. In the next section, I will report the results of a behavior observation study. The main aim will be to show the relative frequencies of the activities listed in the pupil's cognitive map of the science lab.

## Observing Pupils' Behavior

As a participant observer, I can lay claim to a degree of neutrality and have tried to convey the essence of what the science lab is like for intermediate grade pupils. Nevertheless, the picture would remain essentially incomplete without some indication of the relative frequency of the various activities discussed above. Using a behavior observation scale, I observed each of the 80 fourth and fifth graders on five occasions during class time and on five occasions during self-selected time (see Footnote 1, p. 1). Approximately one hour of observing was done each school day for a month. Fifteen different activities were coded, in addition to whether pupils were in groups and their location in the lab at the time of the observation. (A sample coding sheet can be found in Appendix A.) The activity categories and their definitions were taken from interviews with pupils.

The results of the activity observations are shown in Table 1 for the two times. The absolute frequency of an activity over all pupils and its frequency relative to all others (expressed in percent) are shown.

Table 1

Behavior Observation in Longbranch

The Frequency of Activities in the Science Lab

| | Setting | | | |
|---|---|---|---|---|
| Activity | Class time (400 obs.) | | Self-selected time (400 obs.) | |
| | Frequency | Percent | Frequency | Percent |
| 1 [illegible] | 116 | 29.0 | 96 | 24.0 |
| 2 [illegible] | 51 | 12.8 | 67 | 16.8 |
| 3 [illegible] | [illegible] | 1.5 | 3 | .8 |
| 4 [illegible] | [illegible] | [illegible] | 53 | 13.3 |
| 5 [illegible] | 12 | [illegible] | 7 | 1.7 |
| 6 Talking to teacher [illegible] | 22 | 5.5 | 38 | 9.5 |
| 7 Talk to teacher [illegible] | 3 | .8 | 4 | 1.0 |
| 8 Talking to peer [illegible] | 14 | 3.5 | 16 | 4.0 |
| 9 Talking to peer [illegible] | 48 | 12.0 | 47 | 11.8 |
| 10 Helping teacher | 3 | .8 | 1 | .3 |
| 11 Helping peer | 5 | 1.3 | 3 | .8 |
| 12 Playing | 29 | 7.25 | 15 | 3.8 |
| 13 Making | 5 | 1.3 | 30 | 7.5 |
| 14 Fooling around | 26 | 6.5 | 14 | 3.5 |
| 15 Waiting | 7 | 1.8 | 6 | 1.5 |

[illegible]

[illegible] instructional)

As one might expect, there is less [illegible] during self-selected time and more [illegible]. Surprisingly, more playing was recorded in class time. Over the course of the year, I feel the two settings are more nearly even in the amount of playing behavior. In other respects, the two settings are quite similar. Note that very little time is spent in watching/listening [illegible]. This is due to the individualized nature of the curriculum. There is very little instruction geared to the whole class. As we will see in Table 2, although quite a bit of time is spent in [illegible], only one-fourth of the pupils' talk with each other is [illegible] in nature. Group work seems to function primarily, then, to facilitate pupils' nonacademic interests. Notice also that a fairly large portion of pupils' time is spent in [illegible] things.

Table 2

Behavior Observation in Longbranch
The Extent to which Pupils Work in Groups in the Science Lab

| | Setting | | | |
|---|---|---|---|---|
| | Class time | | Self-selected time | |
| | Frequency | Percent | Frequency | Percent |
| Pupils in groups | 78 | 19.5 | 99 | 24.8 |

Table 2 shows that pupils spend 20% of their time in *groups*, and that this figure is somewhat higher during self-selected time. In Table 3, note that children spend a good deal of time *traveling* around the room and along the *periphery*. These figures are related to two activities: *getting* and *watching* [illegible]. Children move around the room to get things they need in their investigations and/or to look at what other pupils are doing. I cannot account for the finding that they spend less time *on the floor* during self-selected than during class. I would have expected just the opposite to have been the case.

Table 3

Behavior Observation in Longbranch:
Location of Pupils in the Science Lab

| Location | Class time |  | Self-selected time |  |
|---|---|---|---|---|
|  | Frequency | Percent | Frequency | Percent |
| At seat | 213 | 53.3 | 254 | 63.5 |
| Traveling | 76 | 18.0 | 84 | 21.6 |
| On floor | 57 | 14.3 | 5 | 1.3 |
| Periphery | 43 | 10.8 | 52 | 13.0 |

It has been my intention only to describe what goes on in the science lab, and perhaps these figures give a better sense of what does in fact happen. Some further results will, hopefully, shed light on the activities of pupils in the science lab. The same pupils were also observed in other settings in Longbranch. Collapsing across several activity categories, Table 4 compares the relative frequency of activities in the other settings. If one takes the view that activities are jointly a product of the particular setting and the particular set of pupils, we can see what the science lab as a setting uniquely contributes to the distribution of activities.

Table 4

Behavior Observation in Longbranch

The Frequency of Activities in the Science Lab as Compared to Other Settings in the School

| | Setting | | | |
|---|---|---|---|---|
| Activity | Science Lab[a] | (800 obs.) | Other Settings[b] | (1680 obs.) |
| | Frequency | Percent | Frequency | Percent |
| Working[c] | 312 | 39.0 | 776 | 46.2 |
| Getting | 118 | 14.8 | 188 | 11.2 |
| Helping[d] | 12 | 1.5 | 32 | 1.9 |
| Playing | 44 | 5.5 | 68 | 4.0 |
| Making | 35 | 4.4 | 43 | 2.5 |
| Fooling Around[e] | 271 | 33.9 | 473 | 28.2 |
| Waiting | 13 | 1.6 | 92 | 5.5 |

[a] The science lab includes class time and self-selected time.

[b] Other settings included. Block, a period in the morning when children have individualized instruction in math, reading, and spelling; other studies, a period in the afternoon when children have a nonindividualized social studies class; and the library where they have a course in library skills.

[c] Working is here composed of categories numbered 1, 3, 6, and 8 from Table 1.

[d] Helping is composed of categories numbered 10 and 11 from Table 1.

[e] Fooling around is composed of categories numbered 4, 5, 7, 9, and 14 from Table 1.

The main finding is that pupils spend less time working and sitting in the science lab and, consequently, more time in visiting, playing, mixing, and fooling around. These differences could be due to a teacher effect, but I think this explanation is highly unlikely. Instead, the IS curriculum provides far more opportunity for these last four activities to occur than do other curricula in the school. For example, in math, once a child has his lesson booklet, he is stuck in his seat until he is finished with it. In science, children get booklets and materials for investigations. Second, pupils are encouraged to work in pairs in IS to a much greater extent than in other curricula, and, consequently, there is more "visiting." Finally, the presence of a wonderful variety of materials in the lab invites making mixtures, unstructured play, and impromptu fooling around.

Table 5 reinforces the figures presented above and the comments that I have made as a participant observer. Pupils do indeed spend more time in groups in science, less time in their seats, and more time moving around the room. Perhaps by now the reader is beginning to share my impression of an atmosphere of movement and excitement.

Table 5

Behavior Observation in Longbranch

Pupils in Groups and Their Location in the Science Lab and Other Settings

| | Setting | | | |
|---|---|---|---|---|
| | Science lab (800 obs.) | | Other settings (1680 obs.) | |
| | Frequency | Percent | Frequency | Percent |
| Pupils in groups | 177 | 22.1 | 124 | 7.4 |
| Location | | | | |
| At seat | 467 | 58.4 | 1188 | 70.7 |
| Traveling | 160 | 20.0 | 173 | 10.3 |
| On floor | 62 | 7.8 | 111 | 6.6 |
| Periphery | 95 | 11.9 | 74 | 4.4 |

Let me briefly conclude this description with a word on pupils' attitude toward the science lab. The word in their vocabulary that carries the highest approbation is "neat," and I never heard "neat" uttered more often than in the lab.

## References

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## APPENDIX A

## Pupil Behavior Observation Schedule

Date ________________ Time __________ Homeroom Teacher ______________ Place ______________

| | Time Intervals | | | | |
|---|---|---|---|---|---|
| Variables | 1 | 2 | 3 | 4 | 5 |
| Pupil's Name | | | | | |
| Location | | | | | |
| Place | | | | | |
| Working | | | | | |
| Getting | | | | | |
| Watching/listening to (I,O) | | | | | |
| Daydreaming | | | | | |
| Talking with aide, with teacher (I,O) | | | | | |
| Talking with peer (I,O) | | | | | |
| Helping teacher | | | | | |
| Helping friend | | | | | |
| Playing | | | | | |
| [illegible] | | | | | |
| Other[a] | | | | | |
| Unidentified[b] | | | | | |

Location Code
A = At seat
B = Traveling
C = On the floor, at play table
D = At teacher's desk
E = Tape table
F = Periphery
G = Out of the room

Place Code
1 = Block
2 = Other Studies
3 = Art
4 = Library
5 = IS
6 = Sci SS

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[a] Fooling around
[b] Waiting