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AUTHOR Peshkin, Alan
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ABSTRACT

This booklet is the fifth of a series of 16 booklets that together describe and present findings for a study which involved field observations and a survey of science teaching and learning in American public schools during the school year 1976-77. The study was undertaken to provide the National Science Foundation with a portrayal of current conditions in K-12 science classrooms to help make the Foundation's programs of support for science education consistent with national needs. Eleven high schools and their feeder schools were selected to provide a diverse and balanced group of case study sites. One field researcher was assigned to each site and instructed to find out what was happening and what was felt important in science (including mathematics and social science) programs. The case study report from the BRT site - a midwestern, rural, consolidated school district in Illinois - is contained in this booklet. (MN)


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Case Studies in Science Education
A project for the National Science Foundation
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270 Education Building
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BOOKLET IV

SCHOOLING AT BRT: A RURAL CASE STUDY

Alan Peshkin
University of Illinois
Urbana, Illinois

October 1976


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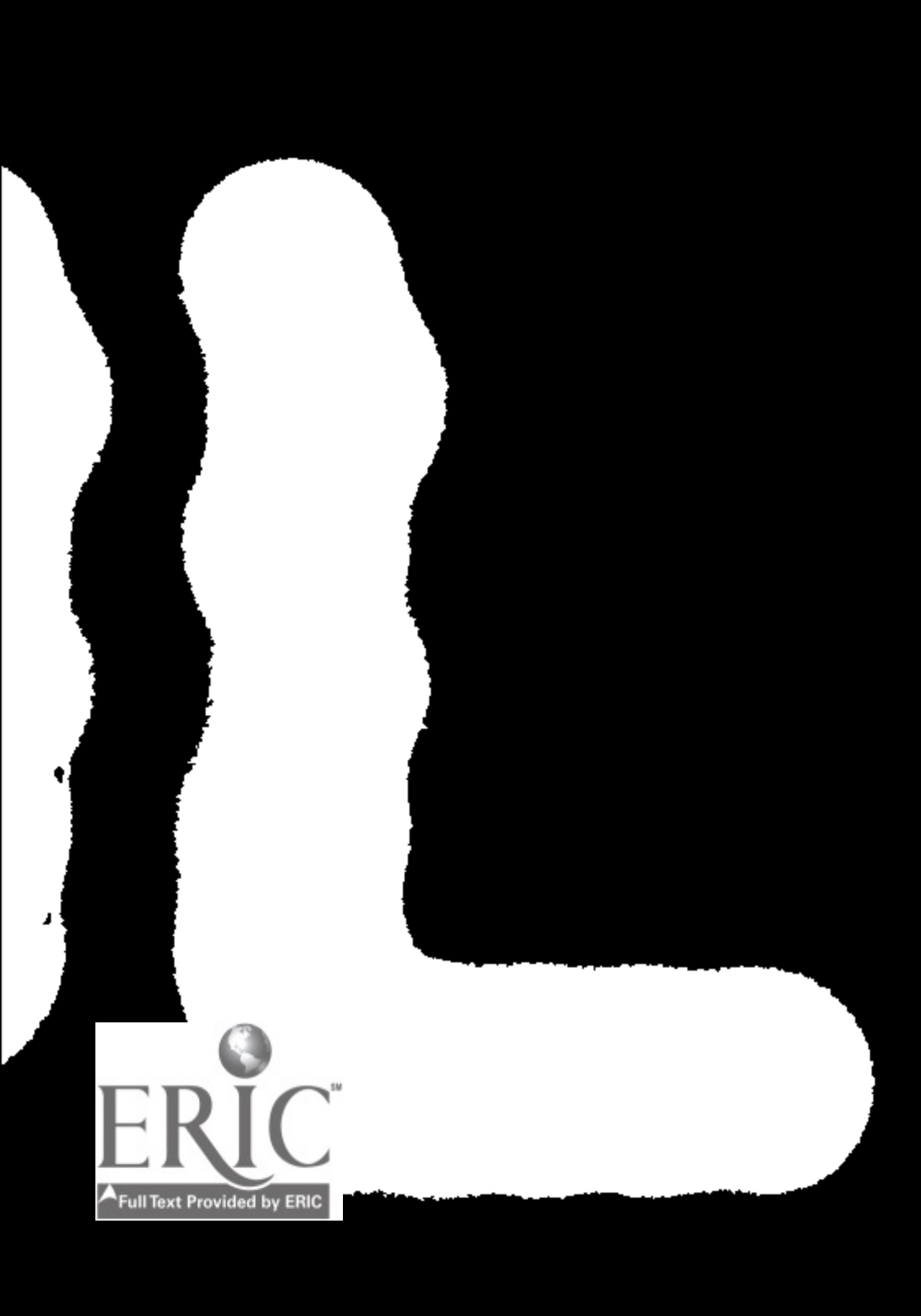
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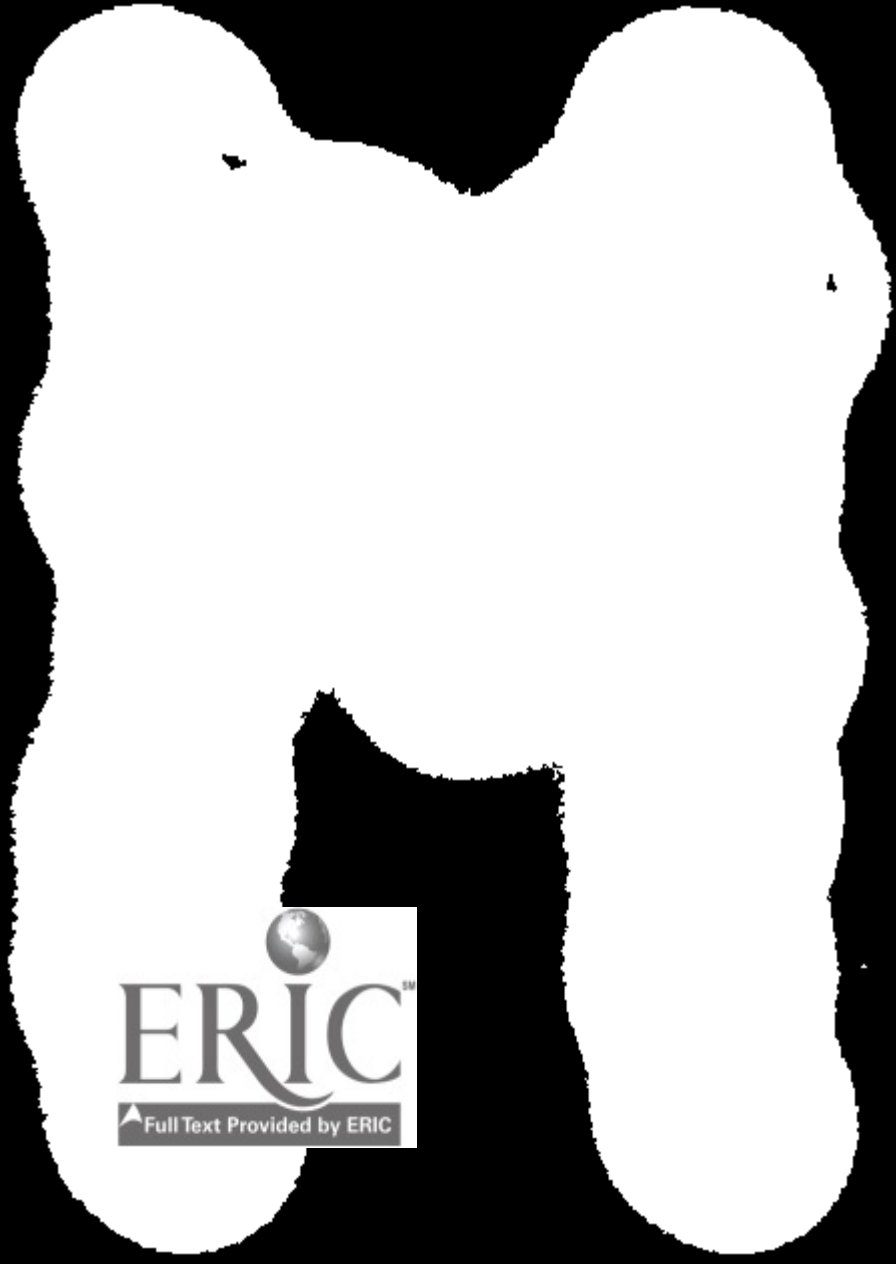
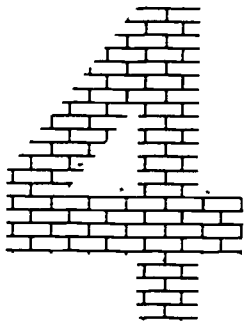




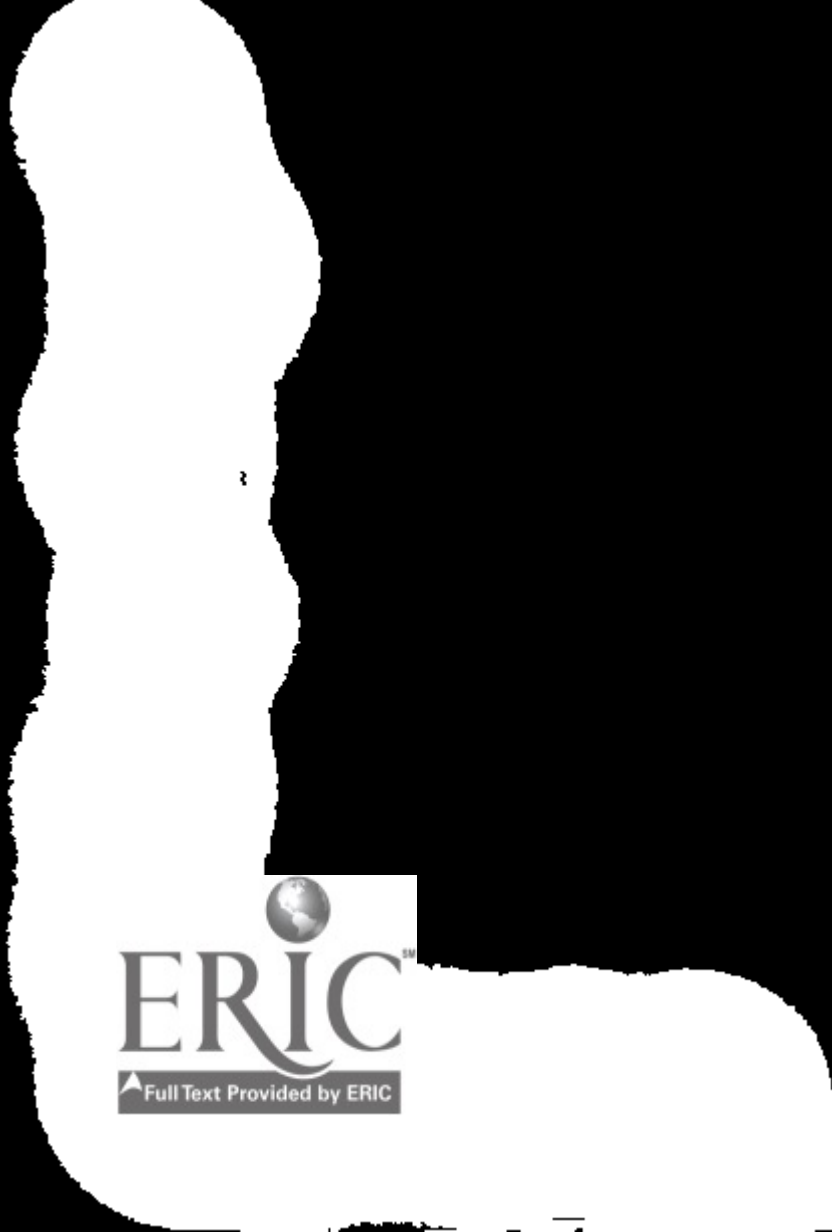
Science is spotlighted in the presence of an outstanding female instructor, the latest in a series of "Mr. Sciences" in this rural midwestern site, and in the surrounding farm lands where principles of scientific management of land, machinery, fuel, and fertilizer dictate events.

Family farms are growing larger; school enrollments are declining as rural market-towns lose their basic purpose and historic functions amidst an urbanized society. The area is prosperous, the schools do not lack for material resources. Nonetheless, another round of consolidation seems near, the observer reports, because of inexorable pressures exerted by demographic shifts and economic forces generated by national and international affairs.

Morale and pride may not be enough, the study suggests, if ingredients essential to a comprehensive curriculum and maintenance of reasonable class size are not at hand. A former board member remarks:

> *I have a neighbor who still thanks me for the advanced math class of only three students he took. This was twelve or so years ago. . . . On the board we discussed that small class quite a bit. In the end, we justified it by the results of the education of the youngsters involved. . . . Now, people often vote their pocketbooks and not their intelligence.*

The sons and daughters of land-holders know where they are going--i.e., back to the farm--and are impatient to get there even if four years of higher education loom immediately ahead. Meanwhile, their classmates leave for nearby cities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and, perhaps, a place in the junior colleges where vocational classes abound.

Current debates over environmental issues suggest that BRT may represent the climax of an agricultural era dominating the United States in the past quarter-century. It has served the nation and its people well, and has produced bountiful harvests for other countries, too. But the accompanying changes in land use patterns have irrevocably altered the face of rural America. BRT stands out as a classic example of this interplay of technology, land, and recent advances in agricultural research.

Maybe, just maybe, seeds of doubt concerning whether a continuation of this course is the most desirable option for BRT, Illinois, the midwest, and the nation are discernible in the following pages. Some readers, however, will see them as an eloquent testimonial to a revered way of life.

"THE MATERIAL IN THIS REPORT IS BASED UPON WORK SUPPORTED BY THE NATIONAL SCIENCE FOUNDATION UNDER GRANT NO. C 7521134. ANY OPINIONS, FINDINGS, AND CONCLUSIONS OR RECOMMENDATIONS EXPRESSED IN THIS PUBLICATION ARE THOSE OF THE AUTHOR(S) AND DO NOT NECESSARILY REFLECT THE VIEWS OF THE NATIONAL SCIENCE FOUNDATION."

SCHOOLING AT BRT: A RURAL CASE STUDY

Alan Peshkin

BACKGROUND

Spirit runs high in BRT, the school district always referred to by the first initials of the three towns that compose this midwestern, rural, consolidated school district. B is for Barton, R for Rhodes, and T for Turnview. The visitor to BRT High School during its most spirited week--Homecoming--would have seen signs attached to walls, ceilings, and lockers urging BRT's Panthers to "Beat Dawson to a pulp" or "Bash their skulls in." The seventh period's family living class took comfort that "The Dawson Bulldogs are sterile. They can't produce a victory." And, indeed, they couldn't. For BRT won this game, as well as the conference championship for the second consecutive year. On the strength of such successes (and others announced in newspaper clippings featured in the display case of the building's main lobby: "Area Youth's Science Paper Second Best" and "BRT Takes Area's Top Science Project Award"), good feeling prevails in BRT, but possibly not for too long; for in the midst of this year's football season, the superintendent surveyed the approximately 1600 residents living in their eighty-three-square-mile school district. This survey confirmed in the most unavoidably drastic terms what had long been sensed and feared by BRT loyalists: the number of children born in the school district during the past five years had declined precipitously, and probably irreversibly. The results showed sixteen children under one year old, eighteen under two, fifteen under three, sixteen under four, and fifteen under five. Moreover, there are only seventeen students in the fourth grade and seventeen in the fifth grade, although the overall total in K-8 of 212 establishes an average enrollment of about twenty-three per grade. A four year high school of under 70 students, in contrast to its present 136, seems not far off, though it is unlikely ever to be reached. Most probably neither the state nor the school district will allow it to happen. From all indications, the forces of consolidation are once more gathering momentum in rural Illinois, and the BRT that emerged in 1953 during its last crest is most likely to be replaced by some new alphabet soup.[1]

In the meantime, contentment prevails in BRT. "Silence," says one school board member, "means things are OK at school. I'm available in my store so I easily hear complaints. A while back we started hearing about music because we only had one teacher. We hired a second one and now that's OK." Parents and teachers are too modest and too honest to claim they've attained educational nirvana. Yet the dominant tone is of general well-being, order, control, and a reasonable degree of success, whatever the domain. The result is a strong feeling of pride. Some teachers are seen as stronger than others, and some wish they could perform more competently than they do, but there is no visible distress directed toward any part of the school program. The band is good and so are the athletic teams. The non-college bound get jobs and the college-bound gain admission to college and do as well as students, teachers,

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[1]About four months after the above mentioned survey, BRT residents were polled to learn their feelings toward consolidation. Of 606 responses, 170 were definitely against it, 329 thought the school district should be looking for other districts favorable to consolidation in BRT, and 103 were undecided. Upon receiving the results of the poll, the school board voted not to pursue the matter further.


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and parents expect. Teachers appear to be in accord with each other and student-teacher relations are amicable. All groups are pulling in the same direction, guided by a shared though not necessarily explicit sense of end and appropriate means.

To be sure, last year's tax increase of forty cents in the educational fund and twelve and a half cents in the building fund was useful, but it proved to be a stop-gap measure, at best, that could not keep the budget in the black or deter BRT's Citizen Advisory Committee from exploring school programs for possible elimination. Notwithstanding the potential for financial hard times, BRT's prevailing sense of well-being reflects the years of affluence enjoyed by its farmers whose astonishingly fertile black soil economically undergirds the school system. And it is their ethos which dominates, because school board members past and present have been drawn from the ranks of farmers. Even the teachers reflect a rural orientation, with fourteen of thirty-three living in the school district and another nine commuting from nearby small towns. In accord, however, with the agricultural realities of the nation, no more than five per cent of BRT's present high school students expressed a desire to farm.

Grades 5-8, BRT's four-year junior high, are located in a venerable building in Turnview, strong on memories but lacking somewhat in modernity. High school students boast that perhaps no other school in the area is as clean as their own, referring to the almost twenty-year old, T-shaped building which houses grades K-4 and 9-12 in Rhodes, the middle town of the three which comprise the district. A most common sight in the halls of the big building is the custodian, pushing his broom with the four-foot-wide sweeper along the never very dirty floors. Any tendency to litter is deterred because of another common sight in the halls--the superintendent. In between class periods, he stands at a crossroads in the high school wing of the building, his presence reinforcing the order to which he is committed. He is a new superintendent, only the district's third since 1953.

In fact, the stability conducive to the establishment of tradition was provided by the district's first superintendent, who administered BRT from 1953 to 1973, enjoying the same five school board members for a full fifteen years of that tenure. And the tradition that prevailed during most of the district's existence is identified as conservative--"We don't buy everything that comes along"--regarding ideas and material goods; respectful of the basics--"We hear about this all the time on the board. We read about it in the journals. Teach 'em to read. There's no kid likely to graduate from BRT who can't read"; and supportive of educational achievement:

> *I have a neighbor who still thanks me for the advanced math class of only three students he took. This was twelve or so years ago. The emphasis then was all who wanted to go to college should have the opportunity, if it was feasible. On the board we discussed that small class quite a bit. In the end, we justified it by the results of the education of the youngsters involved. The education of students was our number one priority on the board at that time. Now, people often vote their pocketbooks and not their intelligence. We had high ideals. Educate kids within our means, facilities, talent, and the capacity of the populace to support. Our philosophy was education.*

By almost any standards BRT is a small school district. It experiences, accordingly, the limitations of such districts, though mitigated by its exceptional tax base.[2] Most

[2]With an assessed valuation of $20,000,000 and an educational tax rate of 2,000, BRT has more money available per student than most districts in the county.


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reactions to BRT reflect the fact of its size, not its rural location. Other than the vocational agriculture program and an occasional teacher's or student's reference to agriculture to exemplify a point, the curriculum is not influenced by its rural setting. Board members say their school should be no different from an urban school, since the overwhelming majority of graduates live elsewhere and don't farm. "The needs of students should be dominant. We educate them for an unknown future." One educator, though, reflects on the mass exodus of graduates with some regret, noting that it sweeps out of the community persons whom he believes would make valuable residents.

> *Academically-oriented kids leave . . . . We don't keep those who use education to advance themselves. The ones who stay look for things oriented to the land. Our doctors and lawyers are all off somewhere else.*

But the limitations of size are not critical, and even those who identify them probably would not wish to pay the "price" of a larger system in order to gain its advantages. A parent says,

> *There's too few offerings on the one hand and too little competition on the other. When my son went to the university he was at a disadvantage in his trig class. The big city kids had a background that he didn't have.*

A board member believes their small size restricts the curriculum. The junior high principal notes the same point: "We can't offer the shopwork, typing, and that sort of thing." He adds, however, that they have solid reading and math.

> *If you go through those files [he says, pointing to a filing cabinet], you'll see that our kids test out slightly above average in all subjects on the Stanford Aptitude Tests. Students leave here as well-prepared in the basics as kids from any school anywhere. And we have no discipline problems like in bigger places. Teachers don't have to take time to worry about classroom control.*

And a parent agrees, with one reservation expressed without concern:

> *My daughter got as good an education at BRT as she would get anywhere. Big city kids function better at the university and in business, but this I think results from the social mix in the city and not from educational factors.*

The curricular meaning of smallness, notwithstanding an uncritical perception of its consequences, is perhaps best captured by these facts: the high school has only one social studies teacher, one math teacher, and one science teacher. (The vocational agriculture teacher offers the required course in earth science; but it is agriculture, not science, that claims his major attention and concern.) Accordingly, if the instructor is weak, a student's entire educational experience in the subject is impoverished. And the subject's program is only as strong as one teacher can make it. Furthermore, the social studies teacher teaches five periods each day and has four different preparations; the math teacher teaches six periods with six different preparations; and the science teacher teaches six periods with five different preparations.[3] Each teacher has one free period daily.

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[3]By choice, the science and math teachers teach six periods. The standard load is five periods, one study hall, and one preparation period.

Within the above general context of fact and feeling, science, math, and social studies are taught. More specifically, however, we see the three subjects enjoying a differential status in several different respects. First, the school requires only one year of math and social studies, while it requires two years of science. (No conclusive explanation was provided to account for this distinction.) Second, variable salience is attached to each of them, social studies laboring under the lowest esteem, with science and math substantially more respected, possibly in that order.

The following set of quotations from parents, board members, teachers, and the guidance counselor will demonstrate social studies' role as academic stepchild, whose only permanence in BRT's high school curriculum comes by virtue of the state requirement of one year of U.S. history. For example, a teacher points to the students' vocational orientation and consequent dissatisfaction with social studies.

> *I've taught social studies. The kids look on it as not really necessary. Even in U.S. history they ask what good it'll do me in making a living. Kids see social studies as something to get credit for that won't be as hard as math and science. So they're looking for a watered-down program.*

A parent believes the students' greater knowledge of the social world turns them away from the study of it.

> *The knowledgeability of students about world and state affairs affects their response to its study. They know more about social studies than about science. So they feel they don't need social studies. This is to their credit, I think. Besides, the whole atmosphere of the school is toward citizenship, not just the social studies.*

One board member observed that there has never been much talk about the subject at board meetings and he had no idea why it was not more important. An administrator of long experience confirmed this observation.

> *There's just been no reaction from the public to social studies. There has been to English, math, and science. In English, if you don't buckle down to it, you don't get it. Math and science need to be talked about in class. But social studies is less controversial as far as the calibre of teaching demanded by parents. In twenty years I had no criticism and it is not as though the teachers were always doing a good job.*

Finally, the conjunction of coaching and social studies teaching during most of the life of the school district has placed this area of instruction in the hands of the least stable person on a high school staff, the coach. One educator felt that it was not the fact that the coaches were coaches that made them poor social studies teachers, but, rather, what they were like as teachers. Another disagreed.

> *Over the years we've had as many games replayed in class as history lessons taught. The tendency is for the teacher-coach to digress in class. And there's not much history taught on the football field. We've been the victim of the college tie-in between a coaching major and a social studies minor.*

Math, in contrast to social studies, is perceived as related to vocational needs. It benefits from the general sentiment of being a basic subject and is therefore taught, indeed emphasized, at every grade up through the ninth. After that, students often perceive it as too difficult, as do their parents. And though approximately two-fifths of the students take a second year of math, many take the vocationally-oriented technical math course. Table 1 below indicates the comparative attractiveness of optional study in math, social studies, and science. Math occupies a middle position in attracting students to its

opportunities, about one-third of the students enrolling in technical math. "In my opinion," says a board member, "math is more important than a foreign language." He continues:

> *I've got to go with my experience. I never took a foreign language. I doubt that my daughter in high school will need a foreign language in later life. Math is tops, I guess, because it's important in my business--electrical work and farming. I can't see a person go through life without math. English isn't that important (look at President Ford), especially literature. I think this is the board's point of view. But we did go for that extra teacher in music. It probably helps with leisure time.*

TABLE 1
NUMBER OF STUDENTS TAKING OPTIONAL MATH,
SOCIAL STUDIES, AND SCIENCE COURSES, 1974-76

Year	Math	Social Studies	Science
1974-75	38	22	39
1975-76	3	29	56

The reservations about taking much more than the required year of math, however, are set forth by the high school guidance counselor, who has mediated between students and their course selections for many years.

> *People are turned off by math because they think it's harder than other subjects. They can say about a course like biology, "OK, I'll get this and I'll relate it to being on a farm." But if they get to advanced math without a goal for using it, they can't relate to it. Local parents are defensive about math, while they know their kids got through earth science and biology OK.*

Among all academic subjects taught in BRT high school, science occupies a special place. Notwithstanding that BRT requires two years of science study (one in earth science and one selected by the student from courses in biology, botany, zoology, chemistry and physics), the area does not predictably draw significantly more students to its classes every year than does math. But it seems to possess an aura of favor, acceptance, and responsiveness to it greater than that of other subjects.

The two-year requirement is variously explained. One explanation holds that it is BRT's reaction to the North Central Association's strong recommendation to that effect at a time when the district had been on a warned basis. Another explanation is that, since the University of Illinois requires two years of science for entering students, it is wise for BRT to do the same. Meeting these requirements thereby qualifies BRT students for any university they would want to enter. This argument does not hold up, though, since the University of Illinois also requires two years of math. "In the end," explains one educator, "the community prefers science and that's how we justify two years of science and not math."

Science has benefited from having been taught by the same teacher, Mr. Burg, from 1953 to 1972. By grading generously he made it easy for students to take science classes. For example, in a two-year period which is indicative of their usual pattern of grading,

Mr. Burg awarded forty-three of fifty-five and forty-eight of sixty students either A's or B's; while Mr. L., the math teacher, awarded only twenty-one of fifty-three and twenty-three of sixty students either A's or B's. The school board appreciated Burg's contribution.

> *When you have a good teacher you try to make use of him if what he does fits in with your program and the needs of the kids. Mr. Burg was liked by the community and by the students. He cared even after they got out of college. Our daughter made a point to see him whenever she came home. He set up our science fairs.*

These science fairs are the closest academic counterpart of the invariably popular musical or athletic performance. They have been and continue to be important in shaping a climate of support for science study. Student projects are prepared, displayed in the gym, and compete with other student projects, locally, regionally, and eventually on a state-wide level. The fairs attract many parents, including those without students in the competition. Being contests as well as displays, the fairs provide a clear sense of winners and losers. "What the people can see and they know they like, you get pressure to emphasize," said one board member. A former BRT administrator acknowledged with regret the competitive aspect. "Parents (look) at the prize end of the fair more than what the kids (get) out of it." But he went on to emphasize the student gain.

> *The fairs give kids incentive to delve deeply. I know my daughter studied DNA. She wrote quite a paper; learned many things I didn't know. The projects were mostly extracurricular, but naturally they also worked on them during class time.*

Mrs. N., the present science teacher, continues the science club and the science fairs begun by Mr. Burg. She exceeds the ordinary expectations of her status and is appreciated for this contribution. Last year, for example, she helped several girls study anatomy on an individual basis during her only free period. Anatomy is not taught at BRT. The board purchased the cats for dissection and Mrs. N. provided the time and instruction. She has the confidence of the board members and gets from them the equipment she needs, though actually she needs little since the larger lab equipment was obtained by her predecessor with the help of NDEA funds.

The next section, which focuses on science at BRT, provides a more extensive picture of Mrs. N. and science education. It contains, as do the subsequent sections on math and social studies, several documents which are intended to portray this study's target programs: interviews with teachers who at the high school and junior high level embody the particular program described in the section; excerpts of notes from high school classrooms' teacher-made tests,[4] and interviews with high school students; and excerpts of notes from grade school classrooms and interviews with grade school teachers. As the product of either handwritten notes or tape recordings, these documents are essentially verbatim statements. They have been edited by omissions, the addition of a transitional phrase or sentence, and in the case of the interviews, the elimination of my questions which served to introduce or change a topic and to seek clarification or elaboration. While editing, of course, bears interpretive connotations, the documentations are nonetheless meant to present a particular reality rather than interpret it. That they are at best a partial representation of reality is evident from the limited sample they constitute for any given teacher and subject matter area.

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[4] I include tests because I believe they are particularly indicative of those things teachers most value, though not exclusively, their students' knowing.

SCIENCE AT BRT

Mrs. N.:. High School Science Teacher

"I taught at other schools before coming here, but they were larger places. I saw a student for fifty to fifty-five minutes a day and that's all there was. What they did with their lives otherwise, I didn't know. Here I think there's not the stigma of, 'You're the teacher and I'm the student and I have to keep all my personal things away from you.' Also, the students here are in so many organizations you keep running into them. And I think they're just much more open. I'm generally here till 4:30 or 5:00 everyday, so I see a lot of the kids. If things aren't ready for the next day, I don't like to leave. Maybe I'll bring papers home to grade, but that's all. There is one thing I miss about a larger school though. The one I was at before gave a free period to the department chairman and he'd come watch us teach and offer constructive criticism. That's one thing I miss here tremendously. There's no one in my area who can come and say 'Now this might be a better way to do this.'

"I've got too much to do at home. I enjoy reading and I'm an avid gardener. Both my husband and I kept tropical fish as a hobby before we were married and we still do. I read everything from the scientific to science fiction to women's magazines. We're magazine poor with our Scientific American, Natural History, Chemistry (that's from our membership in the American Chemical Society), Consumer Report, McCalls . . . You name it and we've got it. There's a couple of journals from the Illinois Education Association and the National Education Association, but none from the Illinois Association of Chemistry Teachers or from the Junior Academy. That's the organization that sponsors the annual science fair.

"For a while I spent summers taking courses for a degree in counseling. Then my husband talked me into taking a rest. He was right; I needed a rest. Springs have always been rush, rush, rush for me. But I like teaching science because I like the kids, and I could never be a research scientist, much to my husband's dismay. After college I thought I could have gone either way. I applied for some jobs in industry and was told by two different gentlemen that because I was female they could not hire me, even though I had better grades and recommendations than some males who were hired. I'm not a women's lib person, you know, but that kind of thing bothers me. At this time it is no longer annoying because I enjoy what I'm doing. I might like that lab situation for a week. After that I'd become very frustrated at the lack of interaction with other people.

"At Eastern Illinois University I majored in chemistry and also fulfilled the requirements for my teaching certificate at the same time. So I was prepared to go either way. I think what really decided me not to pursue industry was my practice teaching experience with Mrs. Dawson. She just didn't turn over the class to me and disappear for six weeks. She helped me set up labs, took home half the homework and graded it, and she sat in her little office between the science lab and classroom and listened to me teach. Then she'd give me lots of pointers. And I also had a grandfather who influenced me to teach. He was a science teacher himself and as children we stayed with our grandparents for several weeks each summer. He passed away when I was in college so he didn't have much influence on my four younger brothers, but my older brother and I both went into science. I've always liked science, though, and I was one of those rare people who went into college with a major and stuck to it for four years.

"What keeps me teaching is the kids. I like teenagers. Also, I like the type of people who are teachers. I even liked teaching remedial science. I once had such a class at another school. It was a welcome change for me. When summer ends I always feel a certain amount of exhilaration about school starting.

"I think science is important for kids to study. Many just don't pay any attention to what's going on around them. Of course, not many will have a career in science, but they have to have a feeling for what's going on around them. At least some kind of feeling for it. I hate apathy. Why let anything go by without even a passing glance? I want students to have an interest in those things that are scientific in their daily life. They should develop an appreciation or a feeling for different theories and beliefs--there are some things in science that aren't that specific--and then extend that to having a more free attitude regarding the feelings of those people around them. I think that's important because our students are so isolated. They are a prejudiced group--against blacks, against Jews, against anyone who lives in the city. Whenever we get a new student, they're very slow to accept that student. So, hopefully, if you can get them to accept different ideas in science, say different ways of looking at the structure of the atom, maybe they can learn to accept different viewpoints over in their social life. Another thing. Recently biology students were looking at cells under a microscope. They were supposed to describe what the cell looks like. 'What am I supposed to write?' That's what they want to know. I'll tell them, 'There's not necessarily a correct answer. Describe what you see.' Then if they do a good job, they have a perfect right to feel some kind of pride because the results are from their own thinking. This is something else I want them to get from science.

"Sometimes I'll ask the kids at the beginning of the semester to write out on a piece of paper I pass around what they'd like to study. The only answer I got that was something different than what I'd already planned was one kid said he wanted to learn more about sex. Well, science as such didn't mean anything to me when I was in high school. It's biology or physics, etc. And within those specific areas it's learning this piece of material and then that piece of material. The students who take the upper level classes are so motivated to do well they can go ahead toward whatever their goal might be. Their grade--that's all they think about. Getting through that test and this test. I would hope this isn't true, but that's the feeling I get from them. Sometimes kids will see something on TV that they'll bring back to class with them. There was a movie on snakes that they asked about, something recently on the La Maz method of birth, and at the beginning of the year a show on spiders. They'll come with questions and we can branch out from there. When we talk about these things that don't have anything to do with what we had planned for the day, it makes them think class was fun. I don't see anything wrong with spending ten, fifteen, or twenty minutes talking about such things on a particular day. It's related to science. If there's one thing I emphasize more than anything else, it's enjoyment. Getting some pleasure from learning. It bothers me when I see kids consider learning as a drudgery. I enjoy learning things and I hope the kids can learn this, too.

"There are very smart students in this school, but they don't join our science club. This is very frustrating to me. On the whole, the ones in the science club, well, their ability is not as good as it ought to be. We run kids so thin here. The boys are in football and basketball and they're doing all these other things. Besides which they're very conscientious students and I have to respect their feelings that they don't have time. Many schools combine a student's work in physics and chemistry with science fair projects, but that's against the Junior Academy's rules. I'm probably too lenient but I don't like to put kids under that much pressure from both science class and science club. Students are out for sports, they've got no study halls, so when are they going to get to my room to work on a project?

"We've got some parents who are interested in science. Of course, I see a special group, those whose kids have science fair projects. Otherwise, I have such limited contact with them. Some parents will push their kids up through Chem. I, so I've got fourteen students in that class. Chem. II and Physics are another story. Students are scared away.

Math is a big bugaboo. Was for me, too. There's a minority of people that math doesn't scare 'em. I'm not in that group. I told the kids that my worst grades in college were in math.

"Today there's less interest countrywide in science than there was when I first started teaching. There's less of a push to be a scientist and more to be a technical person because they make more money. Before, I sensed a feeling that to attain the good life people thought, 'I'd have to go to college and to get to college I'd need science.' Now they see Joe Blow who's forty-fifth in a class of forty-six making $9 an hour and digging ditches, whatever. So they say, 'Why should I bother to do this extra work to go to college, to take science.' We're very materialistic, I'm afraid, and getting more so. Right now, it seems, the shift is back to the basics, like learning vocabulary and laws and problem solving more than technique. Lab technique is still important but there's all this worry about kids not doing well on ACT and SAT. I look at the new texts that are coming out. They tend to be more organized, giving the student information and then expecting them to remember it. I'd say we've always been more traditional here than larger schools in the metropolitan area so I don't think parents were that much aware of a change back, but I get it from parents who are also faculty. You know, 'My son or daughter didn't do well when they took the ACT,' that sort of thing. And the students feel they didn't do well because they didn't know what the words on the exam meant. Especially in the science area. More traditional teaching of science would teach these words more effectively. It would leave out, however, some very important things like thinking for yourself and being able to deduce from a group of information some generality.

"I can see the results of the new math on all the students I've had here. As sophomores, they don't know how to do long division. I mean this is not just the academically low kids. At the beginning of the year I show them how to know what their grade is at any point in time. I can see then that most don't know how to figure up percentages. It really shocks me. Now if you ask 'em about the commutative law of addition, they know what that is. They're lost to science as far as math is concerned. But in lab, they do quite well. At least they have in the past few years, ever since the science teacher in junior high has provided a lab experience. They're much better able to look at an experiment, note its purpose, and be aware if something is happening that doesn't make sense.

"It's really helpful to find students coming to class prepared for science by their past experience. Mr. O. and I meet as often as we can. At the end of some teacher workshop days we can get together. We've worked a lot with chemicals and such 'cause a lot of things he doesn't have. So we share back and forth. This is all informal. But a few years ago when the state superintendent required all the schools to prepare objectives, we met frequently. This forced us to look at what we were doing. We tried not to be so repetitious. That's when we decided to offer some semester classes--botany and zoology, and to not require biology, because they get quite a bit of biological background in junior high. I've tried to encourage more of the students to take chemistry because Mr. O. doesn't cover that as heavily. The primary people were also involved, but most of them don't do much with science. Some do more than others. There's a lot more important things the primary grades must do. At least once a year, though, we try to get each primary class down here to the science rooms. I set something up for them to do. One year we had planaria and so we all watched them eat. Last year we had frogs. We had two living frogs that we tried to let the kids feel and touch. I couldn't hold on to them and we had frogs going all over. The kids thought it was great. They come down so they can get a feel of what science is like. Mrs. T., the second grade teacher, says her kids love to come to the science rooms.

"From my own tests I would guess at least half the class has really understood what I've taught. Maybe another quarter are borderline. I'm talking about biology now. It's very discouraging sometimes. When I give a test I have lots of A's and B's, a few C's, and lots of D's and F's. I don't know whether it's me, the subject, or what. Other teachers

don't seem to get this distribution. In chemistry and physics the results are different because the group is more select. They're mostly A's and B's.

"For the brightest kids in any of my classes I don't do anything that special. Nearly always on an assignment or a test I try to have something that is not answered right in the book. Then I expect only those upper students to get it. And I bring a lot of materials from home when questions come up, things that they can read. I find that I help the lower ability students best in lab. They've usually chosen each other for partners and this helps because this way they're more apt to ask me questions. It's not embarrassing for either one as it would be if they were with more capable partners. In the lab you're not putting yourself up in front of everybody when you've got a question to ask. So I think the lab is an equalizer. Probably the study guide approach is more directed to the low kids, too, at least those who are motivated enough to look up the answers. I try to make up one for each chapter, picking out what is most important.

"These study guides I think are useful for some students. Others find them boring. Anyway, they are not that important in my plans. Generally on Thursday I try to work out the next week in a general way, what material I hope to cover each day, that sort of thing. But just what I'll do on any given day depends on how things went the day before, whether they understand, what the atmosphere in the school is, you know, when they're really up about something else.

"By the middle of October or so I generally have a fairly decent idea of how much material a class can handle. Now I'm all goofed up in Chem II because I thought they'd get more from this one particular reading than they obviously had. My plan book says they're supposed to begin an experiment. They're not ready. This doesn't bother me, though it would some teachers I know who are intent on getting through the book. My philosophy is a little different. What does bother me is when a particular kid is in trouble. You know; 'Why, why doesn't he get it?' Or, 'Why doesn't he have more self-motivation? What can I do?' Sometimes there's a problem with a whole class. Most usually it would be if I'm trying to hold a discussion and all the kids are out of it. I'll just ask the obvious question if they read the material. Generally, they're pretty honest and say if they didn't read it. If not, I don't fight it. I'll give them twenty minutes. It doesn't do any good to stand up there and blab at them. I talk enough, anyway.

"The first year I was here we used BSCS, the blue version. I was not pleased with it. It's very difficult. In a different school where you could group your students a little bit more to reach a higher group of students . . . Oh, it's an excellent text; it just wasn't appropriate. I used to pore over it trying to figure out what the heck they were talking about. Somehow there was not a continuity of ideas. Laboratory-wise, it's very similar to what I use now. I liked PSSC physics. You really didn't tell the kids anything. It was very inductive. With the group I had at a previous school it was very good. They were eight bright, highly-motivated students. It's a risky text as to how much kids are going to get out of it. We decided here to go with something more traditional to try to reach a greater majority of kids. I've got useful ideas from those series. I still like the labs where you don't tell the kids what the answer is. I let them think about it and ask them questions and then respond to their questions. I think that's better because that's what the lab is supposed to do--give them an idea of how general concepts were first determined. If they already know what the outcome is going to be, they don't see the significance of doing the lab. In the classroom this kind of teaching is harder to do. I'm not good at it. I have difficulty asking the right kinds of questions. I can ask questions if I have something physical to look at. Just like today in physics class. I had trouble asking the right questions to get those kids to see what I wanted them to see in that problem about the car on the ramp, that that weight would act straight down.

"Once in a while, once in a great while, you see someone who is truly involved or engrossed in learning something. These are the really good times. They don't happen all

tha[illegible]rted. You know you're never going to get a whole class at the same time asking a lot of questions, not feeling this inhibition about 'she's a teacher, I can't ask a question,' but just interested in learning for the sake of learning and not because of next week's test. That may be too much to expect. Still, you have students who maybe go do something in science, who do well and enjoy it, and you have the feeling that you had something to do with that. Those are the longer term kicks. From day to day, the labs are more enjoyable than classroom work. I think the kids get more out of them. I think I like most interacting with the individual kid. There's students who'll tell you in class they don't know, when they do know the answer. In lab, they'll talk to you.

"All in all, this is a good place to teach. Basically I feel I can be the kind of teacher I want to be. I don't really feel pressured from any direction. There's no PTA. The school board is generous. I haven't asked for big things, so maybe it's been easy for them to agree to my requests. I don't know of any comment they've ever made about my teaching. And it's the same with the churches. Some places have had controversies over sex education. We teach it in health, and in biology when I go over the reproductive system I discuss contraception and venereal disease. We feel it's necessary for kids to know these things. We give it simply on an information basis. Most of the parents prefer that the kids get it here because a lot of them don't know much of this stuff. As long as you don't get into the moral aspect. The only time any of that came up was on the idea of abortion and I don't believe in it either. That's what I told the class, but at the same time it's there, it's available, and you should know what it is. Beyond that, you make the decision based on your family and your religious beliefs.

"Evolution has never come up as an issue: I don't know. My personal view is probably close to safe because I don't see any divergence between the theory of evolution and a religious viewpoint. I suppose I'm not really radical. Maybe that's the reason I haven't had any feedback. If I were an atheist, I suppose that might present a problem. And the students don't make it a problematic discussion either. Never had anyone do that. Here again, our students are pretty much of one mind. They're pretty closed in the ideas they have. I've hardly had any feedback from the community."

High School Science Classes

Chemistry I

Mrs. N. shows a girl how to get the area of a rectangle:

$$(10.0\ \text{cm})(15.0\ \text{cm}) = 150\ \text{cm}^2.$$

S:[5] *Do we have to do the problem that way? [she asks, referring to the parentheses and the units].*

T: *Yes. And don't forget that you get squared centimeters. What about the significant digits? [She and the class count up the number of significant digits on both sides of the equal sign, Mrs. N. emphasizing they must place a line over the zero in the answer. She reminds the class several times about significant numbers. She reinforces certain procedures, trying to*

[5]In this and all other classroom scenes, S is student and T is teacher.

make them habitual, like to what digit you round off in chemistry if you have a .5.] On the test tomorrow, I don't expect you to recall the conversion from English to metric scale. OK, number 38. Jim?

S: I don't know.

T: What is the definition of density?

S: Mass per unit volume.

T: OK, I know I have a long fuse, but everybody seems to be talking about other things now. Could you give me your attention?

The class completes the review of homework problems and Mrs. N. returns yesterday's homework, observing that they had trouble with one particular problem which she then clarifies on the black board.

T: You all did very well, except a few of you misread the directions. Here's something to think about for the test tomorrow: [She puts a problem on the board.] What's the answer to this?

$$\frac{4.0 \times 10^{5}}{2.0 \times 10^{-4}} = 2.0 \times 10^{9} \ldots$$

I'll make up problems. You have to pick out the correct answer. That means you must work out the problem. Those are the multiple choice. Then we'll have to name instruments used in the lab, for example, beaker, graduate, cylinder, burette, pipette, etc. You need to go back over experiment number 1 very carefully. Know how to make a bend, fire polish, transfer solids. There'll be some questions from experiment number 2. I'll give you a data table and you'll make calculations of the percentages of error and so forth. [The students groan.] Any questions?

S: Can you work out some problems like that one on the board?

T: OK, Lisa asked me to do a problem about absolute and relative error.

She works several problems while the class buzzes as it has all period, aroused by having got their class rings as well as by the prospects of the test.

Chemistry II

The topic is the preparation of alcohols. Mrs. N. asks questions about each line of information she has written on an overhead projector. The students take notes. Each line contains formulas and diagrams of molecules. She asks for the name of each substance. She covers up the material on the projector with a paper and moves it down one line at a time after she has asked a question.

T: Look at some specific alcohols. The simplest alcohol is methanol. What is the structural formula for carbon monoxide?

S: C double bond O.

T: *[She continues with a series of questions.] What do you have to do to balance that equation? . . . What are some of the properties of methanol? . . . How does it affect the human body? . . . What are some of its uses? . . . This is commonly called wood alcohol, by the way . . . What do you do when you make a ditto? OK, you dissolve off the surface and deposit it on a sheet of paper. In a true xerox, it's a photographic process and you need graphite. [They discuss the new machine.] OK, then, ethanol. What are some of its characteristics?*

S: *It smells sweet.*

S: *It gets you drunk.*

S: *You use it as catalyst.*

T: *In what? Does it [the book] say? I can't think of any instances. [A student reads examples from the textbook.] Where do we get it from? By what process?*

S: *Fermentation.*

T: *Right. As Dave says, yeast secretes an enzyme . . . When you ferment, you also can produce* CO_2. *What do you use* CO_2 *for? What typical reaction?*

S: *Bread.*

T: *Right. Wines, beer, baking bread. There's a difference between yeast in bread and wine. What's the difference?*

S: *One doesn't produce spores.*

T: *Yes, but a practical difference.*

S: *Speed.*

T: *Yeah, but something else. What would happen if you try to make wine or beer from bread yeast? The bread yeast dies at 6% alcohol, but beer and wine go up to 14% . . . What is ethylene glycol commonly used for? You should all be using it right now.*

S: *Anti-freeze.*

T: *Yes. Why did we stop using alcohol?*

S: *Because it boils off in summer time.*

Chemistry II

The homework for today was questions on the study guide for Chapter 17. The lesson begins with the answering of questions.

T: *What should butadiene really be called?*

S: *1, 3 butadiene.*

T: *We don't often refer to the 1, 3 because the 1, 2 is so rare due to the double bonds that it seldom occurs . . . Number twenty-five. [A student gives the answer and Mrs. N. draws the benzene ring on the blackboard.] Number twenty-five. That's a sneaky one on my part. It's not really in the book.*

S: *I got a CH^2.*

T: *Well. This is a Freidel-Craft reaction, named after the fellows that did it. [She refers to her own book.] I'm trying to figure out where the hydrogen comes from. Oh, yes, yes [she says as she remembers and goes on to explain.] It's also called methylbenzene or commonly toluene.*

S: *Where is that found? In glues and stuff?*

T: *Yes . . . Talking of xylene [she goes to get a bottle of xylene and passes it around to smell], I think you'll recognize it as the stuff in paint.*

S: *And magic markers.*

T: *Go get a can of ditto fluid from Mrs. Smith. We'll read the ingredients . . . OK, number twenty-seven. Now let's assume we read it with one butene. What do you get then if you react it with:* $\frac{AlCl_3}{HCl}$

S: *Butyl benzene.*

S: *Where does the extra bond disappear to?*

T: *Ah [she says and she explains].*

S: *Just moves the bond down. Right?*

T: *Right . . . OK, what is styrene used for?*

S: *Synthetic rubber, SBR.*

T: *OK, where do we get moth balls from?*

S: *Trees. [Students laugh.]*

T: *Coal Tar. What do we use the stuff for besides to get rid of moths?*

S: *Making dyes and resins.*

T: *What do three ring benzenes form?*

S: *Anthracene.*

T: *I don't have any examples of its practical use.*

This small class of five boys has been alert and interested all period. They had done their homework. They joke but not disruptively. They move along the entire period from question to question, finishing just before the bell rings. Mrs. N. elaborates the answers all the way through. There is no mere recital of answers.

To more fully develop the sense of Mrs. N.'s instruction, her study guides and test for chapter seventeen have been included as Appendix A. They suggest her view of what is important in the material her chemistry students studied.

Biology

When the bell rings there's a quick settling down to work. The talk is focused on the tasks involving their microscopes and the assignment. The temperature in the room is twenty degrees cooler than yesterday and one breathes more easily. The same pair of boys at the front of the room is talking and entertaining themselves, audible to the rest of the class, but ignored by all. They're the last pair to plug in their microscope.

Large colored letters pinned to the front bulletin board on a solid gold background spell out the slogan, "Know you're the best you can be." Extending across the room on the bulletin board space over the front blackboard is a sign "Tools of Biology" and in a row are hung a beaker, pipette, rack, etc.--fifteen or so little pieces of equipment. The back bulletin board is covered with colored pictures of flowers, all labeled, under the heading "WILD FLOWERS." Mrs. N. explained that even though the kids don't look at the bulletin board, she can't stand them to be empty. One table near the window is full of her own plants.

Mrs. N. is always doing something. She moves around softly and helpfully, available but not in the patrolling fashion of a teacher self-consciously doing her duty of being available. When not working with students, she straightens out the room yet keeping an eye on the class. She sees a group having trouble finding some creatures in a sample of pond water. She encourages them to look for larger specimens. She does this quietly, with nobody else in the room looking up from their microscopes but the girls having the trouble. Her movement, while constant, is not frenetic; it is soft, serious, and helpful. She smiles easily, often, and warmly. As she passes one table she says, "You seem to be having more trouble with that hair," but not threateningly. At 10:45 she invites the students to put away their microscopes so they can talk about what they've been doing.

T: For tomorrow's quiz you should know the items we've been discussing in class--steps in the technical and in the research method and who uses these methods. What is the technical method? I'm asking you right now.

S: There's an outline to follow and you record the observations and report to someone else.

T: The research method?

S: Define the problem.

S: Collect information.

S: Make an hypothesis.

S: Then experiment.

S: Record your findings.

T: But, before you record . . .

S: Organize your observations.

T: In tables and graphs . . .

S: Draw conclusions.

T: Finally . . .

S: Prepare a report.

T: When people repeat the experiment, then the hypothesis may become a theory . . . OK, the purpose of a control in an experiment--I'm going over the questions in the exam--lots of times we leave this out because we follow the technical method.

S: So an experiment has only one variable.

T: Yes, control everything but leave out one factor. For example, in photosynthesis, give two plants all the same conditions, but leave one in the light and the other in a closet . . . So those are the primary things you should know. OK, check the homework I gave you back. Any questions on the homework? OK, open your lab books. There's some items in it I'll expect you to know, like all parts of the standard compound microscope, what its function is, the wide field stereo micro and what's the advantage of it.

Biology

Yesterday, Mrs. N. passed out two journal articles: C. Hallowell's "The Coming of the African Bees," The Sciences (September 1975), a journal of the New York Academy of Sciences, and G. Alexander's "Bugging the Bugs," Natural Wildlife (August-September 1976). Today each student got a list of questions prepared for each article. They are given about twenty-five minutes in class to answer the questions before they discuss their answers. The class is absolutely silent as each student works on his questions. Mrs. N. is at her own desk grading papers.

T: I hate to interrupt, you all seem to be working so hard, but let's discuss the articles. Which one did you like best?

S: Bees [many students say].

T: I thought so. Why?

S: It's shorter and easier.

T: Any of you heard about these bees? Oh, one or two. [They begin to discuss the questions. They are factual, drawn right from the text.]

T: Why might the bees get here early?

S: Through smuggling.

T: Yes, because we're a greedy people and beekeepers would get them to go after profits. Should you lie awake at night and worry about those African bees?

S: No, because they might not get this far.

T: Right. They'll attack weak animals, small kids, and probably stay in the south . . . OK, you all liked bees, but I liked the other article because I'm interested in ecology . . . Now, the first word is badly misspelled. My typewriter never learned to spell. Innocuous? What does it mean? Any ideas?

Biology

The class sees a film which examines the physical and chemical properties of sulphur and iron, and of a mixture and a compound of iron and sulphur. After the film, Mrs. N. reviews its points by asking questions and writing students answers on an overhead projector.

T: What are the physical properties of sulphur?

S: Hard.

S: Yellow.

S: Not attracted to a magnet.

S: Brittle.

S: Low melting point.

T: I hope you remember when he heated and melted it. What was unusual?

S: It got thicker and thicker.

T: What else?

S: It wasn't soluble in water.

T: What was soluble?

S: Carbon disulfide.

T: What's its density? Since you didn't write this down, you probably didn't get it. It's 1.9. What are its chemical properties as it reacted with other substances? . . . OK, it burns in air. You couldn't see it [because the film was in black and white] but it burned with a blue flame. It had to react with oxygen to burn.

S: It did not react with acid.

T: OK, those are the physical and chemical properties of sulphur. How about iron?

S: It's easy to bend.

T: That's called malleable.

S: Attracted to a magnet.

S: High melting point.

T: Right. I'll put down M.P. Did it dissolve in water?

S: No.

T: What else? Does it dissolve in carbon disulfide?

S: No.

T: It's density is 7.2. OK, the chemical properties?

S: Gave off gas.

T: When reacting with what?

S: Iron and some kind of carbon.

S: Nitric acid?

T: No, but it was an acid. Hydrochloric. If we had pure hydrogen it would have burned, not popped . . . OK, they made a mixture of sulfur and hydrogen. How do we know it was only a mixture? What test did they do?

S: They could separate sulfur from the iron.

S: They put it in acid and got the same reaction as with the iron.

T: What would they have to do to produce a compound?

S: Apply heat.

T: Right. What tests did they do to show completely new properties?

S: Use a magnet.

S: Hit it with a hammer.

S: Ran another test.

T: What was it?

S: They put acid in.

T: Right. They bubbled gas through cadmium sulphate and it bubbled. So there is a difference between elements, compounds, and mixtures. When you get a mixture you alter things completely. Any questions? Comments? No. OK. Friday you'll have a test with open notes. Bring anything you want to use that's written in your own hand. You can copy down the whole chapter, but you can't use the book. Here's your quizzes from the other day. If you want do some extra credit that's also due Friday.

S: Whadja get, Eric? [whispers Eric's neighbor].

As in the case of chemistry, a biology study guide and test are included in Appendix C to portray more fully the nature of the biology course.

High School Students' Views of Science

Several students in grades ten to twelve were interviewed in order to learn of their perspectives on science, and of course, on math and social studies as well. Student comments on the latter two are provided in the appropriate section below. In general, students were asked to describe their school activities, speculate on their post-high school careers, and discuss what they believed science (or math and social studies) was about and what role it plays or will play in their lives..

Beth: A Sophomore

"I've wanted to be a vet ever since I was seven years old. We haven't had much chance yet to study animals, so far. I'm only a sophomore and I've taken earth science and now biology. But I plan to take all the science I can get, same with math. I'm not too inclined to read much, but if I do I mostly like animal nonfiction like this book I'm reading called Animal Kitabu. I wrote a report for English based on this book. I'm trying to get a point across to my teacher because he's a hunter. You see, I don't like the idea of shooting animals because they have no way to defend themselves. In biology the teacher has magazines around like Natural Wildlife. I look through them during study hall.

"In the past we mostly studied atoms and elements and photosynthesis. We started with the basics--structural forms and processes and chemical elements--and worked our way up. We studied molecules and atoms; the things that compose us. We haven't gone into anatomy or the organs yet.

"I think science is the study of, oh boy, simple and complex processes in living and nonliving things. It's the study of things we encounter in life; there's not many things you miss. Scientists study things differently than others because they have technicalities and they write out experiments. An ordinary person wouldn't think that deep down like the scientist does. Science makes you more aware of your surroundings so if you go outside, you don't see it as just another day, with animals, leaves, the sky. When you see a leaf it's not just another leaf. You really understand the world more. Everything is intermingled and has its place. I've had this feeling mostly since the eighth grade on, but more now than anything.

"In biology I'm working in a lab for the first time in my education doing an experiment. We did a little in junior high, but this is lab, and it's so labeled. Lately, we've been talking about cells, what happens if you do something to a cell, like put it in salt water, distilled water, how they react to stimulation, and how they react in certain environments. Next semester we study anatomy and I look forward to that. In biology we've started with the basics. I still wish we'd get to animals because whenever I think of science I think of animals and I don't get much chance to talk to anyone about my interest in animals.

"In eighth grade I remember we studied evolution. We got into an argument of evolution versus Adam and Eve. The more scientific people said evolution; some said you can believe in evolution and in God. But now scientists are breaking through. Science goes deeper into finding out the facts.

"Mostly this semester in biology we do lab work. You discover things that you wouldn't do in ordinary life. You look deeper. Then we read the chapter and answer the questions at the back. There's not much to them; the answers are right in order in the chapter. This work is useful for the tests and for understanding the chapter."

Steve: A Junior

"It doesn't seem like I've ever lived anywhere else, but really I've only been here since third grade. I've got one more year to go after this one and then I'll go to a junior college to study carpentry. They get you into an apprenticeship. You go to school for two years, then serve as an apprentice for four.

"This year besides my courses (U.S. history, technical math, English, speech, art, and P.E.) I'm out for cross country, football, basketball, and track. The last two years I was in Science Club, but not this year. There weren't many kids in the club the first day so me and my friend decided not to enter. It's more fun when there's more kids in because then we can talk to kids about our project. Kids often know more than the teacher. For two years me and my friend got a third on our science fair project when we thought we should have got a second.

"We began science projects in the seventh grade because of the teacher. We liked him real well. He helped us along and got us real organized. There was a science club in junior high. I liked talking to judges at the fair. We told them all we knew, but they said we needed more definitions. We took their words that needed definitions to our science teacher and even she didn't know some of the definitions. Some of them were just over our heads. Maybe next year I'll try again.

"I've taken Earth science and biology, but no science this year. Biology was rather tough. Maybe next year I'll take another science. I'll ask kids in my class about which ones they thought was best, what they got the most out of. Mom wants me to take more science, maybe because she's interested in plants and she wants me to learn more about greenery. I don't know if I'll take any more social studies. I'll wait till the end of the year and talk with Mr. T. He helps me pick 'em. He thinks about what will relate to carpentry. I've been interested in carpentry since I was a freshman beginning in industrial arts.

"To me, science is the study of life around you, the environment, different animals, the insides of you, the study of yourself. No two people can look at the same thing and get the same picture. Scientists look at things different, they take more time to look, while others don't really care. Their opinion overrules nonscientists, but this shouldn't be. There's different theories and theories are made to be broke. Not just one certain theory; each year they're broken. I don't have any evidence, but that's what I believe.

"I think science helps you find out about yourself, what you can and can't do with your body. One chapter I remember reading talks about bones. You learn what you can consume, like carbohydrates, and what's bad and good for you. It helps your little sister in junior high because you can help her with her work. I eat more bread and milk than I used to since taking biology, when we studied calories. If you're healthy, you live longer, and I want to stay around as long as I can. I'd like to have done more experiments in biology. In Earth science we only did one experiment all year. We had lots of equipment, but didn't always put it to good use."

Tammy: A Junior

"My mom's a registered nurse and I've wanted to be a nurse ever since the fourth grade. Next year when I graduate, I'm a junior now, I'd like to go to the U. of I. and study psychiatric nursing. Science fascinates me and it always has. I've been in the Science Club ever since seventh grade when I entered my first project. I don't read much outside of school, but I like science fiction and Star Trek. This year I'm taking Chem I, U.S. history, humanities, Algebra II, and Spanish III.

"To me science is the discovery of things you didn't know before. For a one word description, it's discovery. It's also learning about everything and anything that is in the universe. Scientists are probably more methodical than ordinary people. They are very organized and go about things more calmly in their daily life. In the lab you need to know what you're doing. Science is very, very special.

"For last year's science fair I did a project on psychological patterns in small kids. Got a first in the state. We interviewed kids, all of 'em first-, second-, third-, fourth-, sixth- and eighth-graders. We asked opinion questions about God, lying, what parents meant to them, symbols of authority. Mr. T., our counselor, helped us to develop questions that kids could understand. We interviewed before and after school, during free time. Teachers were very cooperative.

"This year I think I'll do a general paper on archaeology, how it's changed, and how it'll be useful in the future."

George: A Senior

"I've lived here all my life and I probably won't ever move away. My great grandfather came here from Germany to farm. I'll probably study diesel or auto mechanics at junior college after I graduate. Someday, though, I'll become a full-time farmer. I collect guns and I like to hunt and trap. I'm always fooling around with cars, doing my own maintenance, tune ups. I subscribe to gun magazines and Car and Craft. This year I'm taking P.E., consumer education; family living, sociology, and agriculture. No science or math. I've already had Earth science, biology, and botany/zoology and I took algebra and plane geometry in my first two years.

"Science is the study of what makes things tick, like earthquakes and volcanoes, the composition of plants, the manufacture of food, and taking animals apart like night crawlers so you can study organs. In science you have to observe; you remember better this way. You're more detailed if you're a scientist, I imagine. We were urged to observe carefully. Observation and research are linked. You have to observe in the research you're doing. In research you're trying new and different ideas. Science teaches you to observe conditions more carefully. For example, if you're working on an engine, you may know where the piston goes, but you need to get things in the right order. For right now, Earth science and zoology are useful to some extent. Botany isn't."

Bill: A Senior

"I'm a senior and I've gone to school at BRT since kindergarten. I'd like to be some sort of an industrial engineer so I've taken all the math and science I can. This semester I'm taking physics and Chem II, but I'm busy with lots of other things in school, too, like I'm manager of the football and basketball teams, play in the band, and I'm in the Science Club and the Student Council. Out of school I work on my car and motorcycle. I'm a Ford man; I got the repair manuals and do all my own maintenance. We've got a shop at home for wood and metal working so I can ship up parts for my motorcycle. Anything I can make, I do, rather than buy it. I don't do a whole lot of reading, mostly on things I need information about. I'm a Star Trek buff.

"What comes to mind when I think of science? Interpreting things around us, their makeup, the way the elements behave to make some practical thing. Discovery--that's what comes to mind first. Elevating mankind in general, I suppose. I think back to chemistry and physics, when they first started and the way they changed civilization. The past few hundred years things went straight up--discoveries showed us things to use, the light bulb, the jet age. In junior high general science we talked about these things.

"I don't know that the science I've studied has any particular value for me now outside of school. I suppose it has, but I can't pinpoint anything. Guess it's made me more aware.

I notice rock formations and stuff since taking Earth science. As the year goes on in physics, I'll probably use more of it, things like forces, acceleration, and vectors.

"I take everything I can, and it doesn't cost you that much to learn it. Learning is like an investment; it's the best thing that you can do. I think more kids should take these courses; won't hurt 'em to take the courses. It's silly to sit in a study hall."

JUNIOR HIGH SCIENCE

The last three years at BRT's junior high, comprised of grades six to eight, are taught on a departmental basis. Only the fifth grade is a self-contained class. Since the school is six miles away from the main building in Rhodes, its teachers are a group unto themselves. They do not so much feel isolated as they feel apart, having formed good, cordial working relations with each other over the years. However, unlike most junior high teachers, Mr. O., the science teacher, is involved with the high school because of his job as assistant coach of basketball and football. His background and observations about science are joined with those of several grade school teachers to complete this characterization of science at BRT.

Mr. O.: Junior High Science Teacher

"This is my fifth year as a teacher and my fifth year in BRT. I teach science most of the day and I'm an assistant coach in football and basketball. Originally, I'm from a small town--there were 300 students in my high school--and I went to Eastern Illinois University to study zoology and botany. I want to say I got nil from my college education courses. I've reread my notes to look for help in them. Nothing. If I go back for a master's, I'll do it in science, not education. Outside of school I like activities associated with the outdoors like hunting, fishing and trapping. I work with a neighbor to trap muskrats. My schedule is busy, but I read every chance I get--science journals, science fiction, that's what I like. And I subscribe to People and sporting magazines. I get old copies of Scientific American from Mrs. N. at the high school. As for organizations, I belong to the Illinois Education Association, but I'll drop it this year.

"My dad is a science teacher. He taught in my high school--I took courses with him--and he's still there in my home town. I admire the way he deals with kids on a one-to-one basis so the kids feel they're worthwhile. As a teacher, he uses traditional methods, always trying to tie in reading and lecture materials. Students will read a chapter, answer questions on it, discuss the questions, and investigate. It's not open or individualized.

"I wanted to teach science because I'm really interested in nature and seeing how things interact. It fascinates me how the natural world affects civilization. The major advances in science--they overwhelm me. I try to point this out to the kids. I try to bring it in in all units I teach, to impress kids that the world is changing from a natural point of view, you know, geological changes, climatic changes. I'm interested in improvements in technology that change our life style, things that the kids take for granted. Kids need to learn to appreciate. They're sharper than we think they are. I've talked about corn and its evolution from a small cob to its present size. The kids got a kick out of that. I try to relate all things to life outside the classroom.

"In my first year of teaching, I was strict. I followed straight lecture with lots of paper work for students. Since then I've relaxed, but I'm still very traditional. Now for the first couple of months we work in the textbook and for the rest of the year, it's mostly lab. We use ESS materials. I get some telephone calls when we do the lab work because parents wonder why no book is brought home. There's no need to. The students do their experiments and write-ups right in class. I don't like to see students take home books; the school day is long enough. I like to get all my work done during the day and not after the school day.

"In the junior high curriculum at the sixth grade we emphasize behavior. We study meal worms, a little biology, electricity, and astronomy. In the seventh grade, it's strictly biology--ecology in the first quarter, then conservation education, the human body, and animal anatomy. The kids are surprised to see the comparison between the insides of a frog and a man. Earth science and chemistry are what we concentrate on in the eighth grade.

"There are some general concepts I think are important. In sixth and seventh grade, we try to see the interdependence of things, that things on earth are not totally separate from each other. In eighth grade, it's natural events and how the world is changing, how the earth is constantly changing, as well as civilization. In chemistry, the concept is to get a perspective of how things are put together. For example, this desk and I have something in common--particles. It's difficult to get concepts across. At this age, kids like generalities. They have misconceptions about the natural world that come from cartoons.

"There's one important attitude that I stress. It's appreciation. It often comes out later when students are in high school and they think back. I try to get them to see that we're here on earth for only a short time, so we need to understand the world a little better. They can't just get whatever they can get out of it. They have to think about why they're here and develop an awareness. People should see, be aware, and be in it--life, everything living. 'Don't go through life just to go through it,' I tell them. 'Get something out of it.'

"I'll tell you what I like most about teaching. It's being able to communicate and show kids, 'Hey, somebody likes you.' Parents put pressure on them. At this stage their body chemistry is changing. They've got choices to face. If I can get a kid to smile when he doesn't want to smile . . . . People cared about me when I was growing up and I like to pass this on. I like to show kids that somebody above the age of fourteen likes them. Sure, there's frustration, like over getting kids to understand, to see what's happening. They turn off or forget, usually around Thanksgiving, Christmas, and the last few weeks in March. I'm tired then, too. I get tired of searching for new ways to do things, especially after the football season's over, but this passes.

"I'd love to get all kinds of things if I had the money. I'd give kids more materials for investigations they can conduct throughout the whole book. I'm still developing. I've changed what I teach, but not how I teach. Some kids want to do special things of a scientific nature. I'm sorry not to have the time to help out. There's not a lot of resources here in BRT, places to turn to. I've thought of giving over a week to projects, but I'm afraid they wouldn't come up with projects, and I couldn't think of one for everyone. Some of our junior high kids do prepare projects when they participate in the science fair. Used to be that all the kids had to have a project. I don't believe in that. I can't help with organizing the science fair stuff until the middle of February because I'm working with basketball. Many kids are very busy, anyway, because they're in sports and the band and they don't have the time.

"My biggest complaint about teaching is the frustration thing. It comes from motivation. I don't know if it's me or them. I don't understand why kids are not more motivated. Part of the answer must be in me, but it's hard to look at yourself and see other than what you want to see."

GRADE SCHOOL SCIENCE

Mrs. B. and Mrs. T. are two of the four lower grade teachers at BRT. They each teach science in their own way, unconstrained by the need to coordinate their efforts with each other or with the next level of schooling, the junior high. At the primary level, each teacher feels free to be as formal or informal as she likes, emphasizing science only to the degree that she is moved by her own tastes. Accordingly, Mrs. B. probably emphasizes math and social studies more than science. Mrs. T., the second grade teacher, is shown at work in her classroom, engaging her students in a science discussion of the sort that occurs with some frequency under her direction.

Mrs. B.: Fourth Grade Teacher

"For science I still believe in a hands-on approach to learning. Kids can't take a concept and read about it, even if they're interested in it. They need to apply it. I see science as a broadening of general knowledge about things that relate to the natural world, getting into physical things like the weather, which some students really want to understand. Science is most useful if it is something they can apply. Take symmetry. It came up in one of our lessons but since it's not in their lives they're not interested."

Mrs. T.: Second Grade Teacher

"At Illinois State I studied home economics and general science. I'm grateful for my science background. For example, if we have a reading unit on animals we will branch out more than required for the reading and get into the beginnings of research. Right now we have a story on the weatherman. I asked them to watch a weatherman for Monday and to bring maps to school. I try to make the students aware, to observe, to see. I like to tie in what we study with their home life, like a recognition of the seasons as they relate to what daddy does in spring and fall.

"On the primary level I don't teach for grades or testing. I don't feel this is the way to do it. It's open-ended. Exposure is important. A kid will become aware and will know he's heard something before when it comes up again. I teach kids the thrill of seeing things. During sharing time one lad told of seeing a red fox. His eyes sparkled. He wanted to share it with us. This is a science observation, an awareness of the wild creatures, where they see them. We'll look up the common ones, the number of babies, the food they eat, where they live. We spend more time on the things they see.

"When we had fossils in the room, the kids enjoyed them. They examined them, looked them up in books, and talked about them. This is primary science to me. I don't agree with Jerome Bruner. You might be able to teach anything to any kid, but it's not worth the effort. I think they should become more aware as things are familiar to them. Then, they can get more later.

"In the second grade, the most important thing is that we should spend half our time on reading and related activities. They need reading to function in our school system. Of secondary importance is math. From my point of view, we might as well be reading things that talk about science. Little boys don't like fairy tales. Science stories motivate them better. Our reader contains much science and I chose to pull it out. We have a story coming up on road construction. We'll discuss the equipment. Kids out here are familiar with large equipment. They understand bulldozers. We'll talk about dump trucks and which end does the lifting. They know because they've watched them operate. To me this is just practical science. We discuss the work of the roller and why they do it so many times. They'll bring their toy equipment used in road building, their bulldozers, dump trucks, etc."

Mrs. T.'s Second Grade "Science" Class

T: Why do the leaves turn color?

S: Because it's cold.

S: It's a sign of fall.

S: Because there's no sun.

S: Because when winter comes, leaves will be gone.

T: When will new leaves come?

S: In the spring.

T: Why do the leaves turn colors?

S: Because of the cold.

T: Kenny, sit up, I like to see your face . . . OK, we just want to hear what you think about why they turn pretty colors this time of the year. We've heard because it's cold.

S: Because it's October.

S: Because it's getting too cold for them.

S: Because it's Halloween.

T: Do you think everybody celebrates Halloween?

S: Noooo [students answer in a chorus].

T: OK, now, what about the leaves?

S: Because of the sap.

T: What about the sap, Sheila?

S: The sap turns colors on the tree.

T: Where is the sap?

S: In the leaf?

T: Susan?

S: In the tree.

S: In the leaves.

T: Is sap on the leaves?

S: It's in the middle of the tree, but it starts to come out because there's too much in there.

S: The sap is in the limbs and the limbs fall off.

T: Do many fall off this time of the year?

S: No.

T: Do all trees lose their leaves?

S: No, sticker trees don't. The ones that have like sticky things. They hurt.

T: Which trees are you talking about?

S: I mean the green one on the playground.

T: What do you call the leaves of an evergreen? Because they certainly don't look like leaves.

S: Stickers.

T: They do have another name. Think of your Christmas tree.

S: Pine trees.

T: Yes, many are, but what do you call the leaves or stickers? Do you remember, Susan?

S: Pointers.

T: How many of you get real Christmas trees? What do you call the things that fall off the tree and mom says it's time to take it down?

S: Branches.

T: What do we call 'em?

S: Stickers.

T: Did you ever hear the word needles?

S: Awww.

T: Do evergreen trees lose their needles? Some do but not all when they're living. These trees do. What kind of leaves do we have there? [She holds up a leaf.]

S: Maple.

T: What is this other one?

S: Sassafrass.

S: Tulip.

T: Yes, tulip poplar. Well, it's time to go outside.

T: Do you know what these are, children?

S: Oak.

T: They aren't so pretty, are they?

MATHEMATICS IN BRT

Mr. L.: High School Math Teacher

"I've been a teacher for twenty-two years, fifteen of them here in BRT and the other seven in the next town just south of here. In fact, I've been living and working in small towns all my life. I'm a preacher's brat. My father was associated with the Wabash Conference of the Free Methodist Church and he was transferred from town to town on both sides of the Wabash River. I suppose I was a little upset having to move my senior year, but I don't really recall too much about being upset before then. In fact, the only thing that disturbed me about moving so often is I missed taking chemistry. The school I was going to graduate from was teaching physics that year, chemistry the year after, and I'd already had physics.

"I guess you could say I came from a family of teachers. My dad, of course, I'd say he was a teacher and mother was teaching at the time she met him. And I've got one brother and two sisters, all of them trained teachers, though my brother ended up as an administrator.

"At heart, I'm an outdoorsman. I get a great deal of satisfaction from gardening and yardwork, and I love hiking and bicycling. Right now during the fall it's mainly bicycling around town. The kids around here will tell you I'm a hiking nut. I like to hike out in Colorado. Now last Saturday I was in that Walk for Mankind that covers twenty-five miles. It's a challenge and I enjoy it. Since about 1960 every summer we've taken at least one trip to the West. And we've never failed to have a garden. Right now I have one which is about forty by one hundred feet.

"Besides these outdoors activities, I'm constantly reading. I try to mix things up, but I think I tend to read fiction more than nonfiction. I like westerns and spy stories. I read the newspapers quite a bit, also magazines. I'll occasionally pick up some of my wife's magazines, Psychology Today being the one I read most, I suppose. Of course, I do get Arizona Highways which I read all the way through and a little magazine by the name of Colorado. Keeps your Western interests alive. The Arizona Highways is once a month and the Colorado, well, I guess it comes around every three months. I used to get the Mathematics Teacher and I tried to make use of it in the classroom. Most of it was so beyond the kids that I found for me to sit down and figure things out was good recreation, but to try to revamp it as something for the classroom just wasn't quite worthwhile. I got Mathematics Teacher up until this year. We've cut out everything that we didn't think was essential till we get our footing with our daughter in college. One of the things we cut out was subscriptions and also memberships in various teacher's organizations. If my wife and I both belonged, it would be in the neighborhood of $300. We still subscribe to a couple of newspapers. It's the Denver Post on Sundays and a daily newspaper out of Champaign. Sometimes I'll combine reading and TV, watching shows like 'Baa Baa Black

Sheep' and comedies like Bob Hope and Dick Van Dyke. I'll watch sports, but very seldom throughout a whole game. There's nothing that I have to see. I like to watch TV; it's an escape.

"I went to Greenville College, a four-year school with about 500 students. Everybody knew everybody else. The faculty was quite relaxed with the students. There was a lot of camaraderie. I think probably they considered teacher-training as their prime function. We got our actual teaching experience in Greenville high school. I think probably what carries over from those days is I've always tried to set high standards for students, maybe too high for a lot of them. Another thing that carries over is negative, I suppose. One of the classes that I least like to teach is where I had my student teaching, in general math with the kids of lower ability. I've never quite felt as comfortable with them as I have with some of the others.

"In general, I think I would require two years of high school math. Now we only require one. I suppose if we had two required years you could set it up as a two-level program, the one level being for those primarily interested in mathematics, where their subject areas for further study are going to be related to mathematics, especially towards higher education which would be essentially what we've got now. For the other level I would probably require a general mathematics course and then sort of a combination of algebra and geometry so students could get a feeling of other topics besides just what we consider to be traditional arithmetic or something like that.

"At present students can fulfill their requirement by taking practical math or algebra. The basic thing that I try to get across in practical math is the idea of being accurate. Also that all of life can be related to mathematics. So all of the subject areas that we try to get out of this general math course will be things that relate to their own experiences. For example, if they're going to be involved with taxes, paying bills, writing checks, balancing checkbooks--all this sort of thing. I really think it's probably necessary for the majority of people to know these things. Of course, we now have the required consumer education course and several of these areas are covered again, but we've always found it useful for the students to have some idea of those things before they get to consumer education.

"In algebra we talk about the structures of mathematics, that there are patterns that you can look for. I suppose that what it boils down to is it really involves a lot of thinking as well as manipulation of terms and numbers. I don't know how to explain it any further, except in those terms. Structures . . . if you want to call them rules or properties or whatever. A very simple example is what we call the commutative property. If you want to add two numbers, it doesn't matter which you chose first and which you choose second. You should get the same result. So you can set up a whole structure of rules and regulations that will go for the algebra. And you can carry it over into geometry and Algebra II and senior math. Rules are the basic structure that are set up.

"In addition to the required courses, I teach a number of nonrequired courses, ending with senior math. The majority of students in them would be those who are preparing for further academic work. A lot of them would also be interested in science and see the relationship between the math and the science. Many have an interest in math, as well. Some students, by the nature of their intended life's work, are encouraged to take further math. Others, I suppose, just end up taking the same courses as their buddies.

"I think a lot of students are strictly looking at their achievement in terms of a grade. They may be motivated, maybe from home, to get certain grades so that other things good and nice will happen to them. A lot of them are thinking in terms of 'what do I have to accomplish day by day,' and to them that's all it's about. Others look at math from the

viewpoint of, well, I've got to get through this, it doesn't mean anything to me, but here is the method and the example and I'm going to do it and that's it.

"I don't get too much feedback from parents one way or another. Occasionally, you'll get a negative report. I'll give you an example. One student's parents called last year because they thought this student should have gotten a higher grade since so and so did. I informed this parent that in this particular course we did not grade on that basis. They could not understand that at all. I tried to point out to them that most courses are based on competition between students. That this wasn't always done, they weren't ready to accept. The only real feedback as far as methods is concerned are your students. Some that have gone on will mention that they did certain things that were useful to them. Of course, you get a negative side where someone will say, 'Well, you seem to understand it, but you don't explain it well enough for the students to understand.' My only retort to that is that if the student doesn't understand, then they must ask the question. They must ask will you explain it again, will you explain it in different terms than you did the first time.

"Most parents, of course, won't voice an opinion. I think the general one that I get is, 'Oh, I was never very good in math.' I hear an awful lot of that. I suppose I should ask the question, 'Well, why do you think you didn't do well?' I look at this response as an excuse. I'm sure there are areas where everyone is weak. I recognize that. But a lot of times they say that and it's just an excuse. To a lot of them it's easier to say, 'We didn't do well, so why should we expect our kids to do well?' I think many parents have too low expectations for their children. On the other hand, maybe I expect too much.

"Our whole curriculum here followed a new math approach soon after the books came out. To me, new math is new methods, but not particularly new content. More recently we've gone to metrics, but this is not new, it is just a new emphasis. New math got down to more rigorous math, looking at patterns instead of working . . . Take multiplication. Instead of just multiplying two numbers, we break it down. We write 25 as 20 plus 5 and multiply it by 4, each number by 4, so we can show we get 100. This way students learn the patterns of math. It didn't bother me that much to switch to new math because I was really into the math more, being it was my major and I had had additional work. It was not traumatic for me as it was for other teachers who did not have so much background in math. My methods did not change so much. Students had trouble accepting it, however.

"What I like best about teaching is naturally when I get students who perform well, especially if they carry on beyond high school into college work. It also feels good to grade tests and see the students do well.

"I like most to teach precalculus and then trig. I suppose it's because of the weeding out process. Generally, students who reach the senior year are the most capable ones. They have goals, they know what to expect from themselves and from me. There's a camaraderie, a mesh of ideas and personalities. So I feel most comfortable with them. They know I expect a lot out of them. The good ones will give you more the more you expect. What bothers me the most is the kid who elects to take a course and then does nothing with it.

"Neither the board nor the superintendent limit the way I teach. If my textbooks are not up to date, the board might urge me to get new ones. My senior math book has 1940 as the first copyright and 1955 as the next. The book I use for reference has a 1964 copyright. The materials are basically the same in the new and the old books. If new material is available I'll add it to old stuff from the 1955 book. So my students don't lose out on the new materials.

"Things might be different if I worked in a larger school. They set up programs for teaching students, the college bound, etc., This could make a difference. My daughter learned chemistry in high school from a teacher who went at a rate that allowed all the kids could understand. She did not complete the text within the year's time. So at college she had trouble with chemistry for the first nine to ten weeks. I hope we push kids hard enough so they have the background to go on. As far as discipline goes, the large classes in big schools could mean that some students do not get the material. Here there's not many disruptive kids.

"I suppose I've changed my teaching methods from time to time. I guess you should change each year when different classes come in. I've changed techniques but not great changes. In geometry, to cover important material, I demonstrate a great deal on the blackboard. I've always done this. From time to time I tried to let the students do this, but it's too frustrating to me. They try but the results are not predictable. So I do it. In general math, the kids are willing to work the problems on the blackboard, I suppose because the problems require simpler procedure. This is OK with me. It doesn't take so much time to do this. Part of the beauty of math to me is its abstractness. There are consistent patterns. It doesn't call for that much change in the way it's taught or in what's taught. Content-wise it has not changed; it's just emphases that change occasionally, either out of necessity or for the sake of trying to see if a new way is better."

High School Mathematics Classes

Algebra I

Students are counseled to take either general math or algebra on the basis of their scores on a math aptitude test. If a student is slightly below the cutoff point and he really wants to work, explains Mr. L., then he can be admitted to Algebra I. Also, parents can come to school and get their children's schedule changed to one or the other course. "It's their choice." In general, students opt for one course or the other depending on whether or not they are bound for college. The textbook used in Algebra I is Algebra by R. E. K. Rourke and H. W. Sye. Its preface indicates that the book is an "introduction to algebra for capable students" and that the "authors have sought to combine the best of the new with the best of the old."

The tone of Algebra I differs markedly from that in technical math. Here the students come to class having all done the same exercises. When the bell rings, the hand waving begins. Mr. L. takes each homework problem in turn, the students waving their arms to be called on for the answer. One or two students seem always to know the answer and Mr. L. will recognize the same student in quick succession. As the class continues, the number of hands raised markedly declines. Then the teacher's deep, robust voice is heard increasingly as he feels obliged to provide extended explanations to the more complex problems. If a student offers the incorrect answer, Mr. L. calmly explains how to arrive at the correct one. He does not scold or scorn those who appear not to understand, but remains outwardly calm at all times, seeming to enjoy those occasions when an elaborate problem can be worked out on the blackboard. It is not uncommon for him to smile and say, as he approaches the more difficult problems, "OK, now here's a little tougher one," suggesting a sense of pleasure as he anticipates the work associated with such problems. If a problem does not appear to have troubled anyone, he will ask, "Any problems with this one?" and hearing no response, he will move on to the next one or, possibly, add a comment designed to assure understanding of the general point. While discussion of the homework is proceeding, some students, who did not do the homework, write down in their notebooks the correct answers that are read out either by the students or by the teacher. On one

occasion, a student asks Mr. L., following the explanation of some point, "When would you use something like that?" Mr. L. responds, "Very seldom. Mainly it's the thinking and the manipulation process that is important."

Once all the problems have been discussed, Mr. L. assigns the next day's homework, invariably leaving time in class to begin the new problems. If it's a Friday, students may protest their weekend assignment, pleading a big football game or a too busy weekend. Mr. L. is unmoved by such protest. In the time remaining in the period, students break into pockets of buzzing; some of them, however, do use the time to begin their work.

From time to time, the students are given a quiz, such as the one in Appendix D that was taken early in the semester when the work was devoted to the study of sets. Such quizzes are meant to check the degree of mastery over material studied and as a revew for the more comprehensive tests. The results of such quizzes are not always recorded.

Technical Math

This course is taken by juniors and seniors who are not too proficient in mathematics. It begins with the fundamental processes of addition, subtraction, multiplication, and division and is designed to have a strongly applied nature.

Very early in the semester, Mr. L. prepared and ran off contracts for this class, seeing them as something different he could use to motivate the class. He is not using contracts for any of his other classes. A copy of the contract follows:

> I, _____ contract to do a minimum of _____ tests during the _____ quarter with an average of 75 or better for a grade of D.
> If I do _____ tests, with an average of 81 or better, my grade will be a C.
> To obtain a B grade, I must complete _____ tests with an average of 87 or better.
> If I wish to have an A, I must do at least _____ tests during the quarter and have an average of 93 or better.
> In addition to the foregoing, I realize that my notebook should be in satisfactory condition and that I will have conducted myself properly in classroom activities.
> I should fully understand that each test less than that for which contracted will result in the lowering of my grade one step . . .
> SIGNED: _____ Date _____

The students were very much aroused the first day they received their contracts because different amounts of work were required from each student in order to obtain the same grade. The class did not ask for an explanation of this arrangement and Mr. L. did not offer one. In fact, however, a very definite plan was followed to determine the amount of work a student should do. Each student's score on a standardized math aptitude test was added to his IQ score and divided by two. The result was a score that was used to determine the number of tests a student must take to get a grade of D, the number of tests increasing by one for each higher letter grade.

Once the students understand this new system, they enter the math room, chat for a while, and then without comment from their teacher settle down to work. Each student works at his own rate. Some are obviously intent on completing the assignments, their faces bent over their books, their pencils moving rapidly. Others talk, work, talk, work, in a

not always productive fashion. The nonwork noise ebbs and flows, sometimes reaching a crescendo. At a particularly loud outburst, Mr. L. may look up from the work he is doing at his desk. When a student finishes a set number of the exercises, he can come to Mr. L. and ask for the appropriate test; the test completed, he moves on to the next set of exercises to prepare for the next tests. Occasionally, Mr. L. walks around the room glancing at the students' work.

High School Students' Views of Math

Beth: A Sophomore

"I'm taking plane geometry this year. I can't see what it'll help you do beyond school. As parents you may do algebra, but there's no possible way that I see how plane geometry helps. I know it does, but I can't think how it does. That's the main problem. Algebra is more helpful in situations where you have to calculate different numbers.

"Plane geometry is not my favorite subject, but they say you should take it if you want to get into the U. of I. I don't know what I'm getting out of it. I can't really say anything now. You study and cram for the tests and that's it. I can't remember back to what we did earlier in the semester. The teacher knows what he's talking about, but I'm not really sure I know what I'm doing. He's over my head. You've got to do it on your own. If you ask for more explanation, it gets even more complicated. You can't get away from the technicalities, so you really have to work to understand. I want to understand it, but it's hard. I got a B for the first quarter. I want to work up. Now we're on geometric proofs and that goes back to algebra which I pretty well understand. I got along well in algebra last year.

"So, I'm not a bad student, I just don't have that much interest in it. I didn't have more interest in algebra, it just came easier. So far there hasn't been much connection between the math and the science I've studied. There was in eighth grade in conversions of Fahrenheit and centigrade. This is easy to do with a formula. In high school there's been no connection.

"Here's what we do in plane geometry. We go over the assignment from the night before and get a new one. The teacher sometimes will explain what we're going into, but not always. This may take the rest of the period and, if not, we get time to work in class. We get an assignment every night. They're quite lengthy. It would be better if we got shorter assignments and not every night. When we come to a new topic, he should give us a break. Do a topic on Monday to Wednesday, give a breather on Wednesday night, and begin the new topic on Thursday. I don't have as much homework in any other subject. It takes at least one hour. It's not collected, only once in a while to catch us, so I don't do it that much. I look it over in study hall, but I don't really write it out. That's probably my problem. Only a few kids do it every night. I understand when I see it on the blackboard, but not when I do it at home."

Tammy: A Junior

"Mr. L., our math teacher, he can talk above our heads, but we can joke with him and say, 'Get down four feet to where we are.' He takes this well. At the end of class he'll look around and say, 'I got a joke.' I have fun in math because he makes it fun. I'm

about a B student. He never loses patience. If he sees our blank faces, he'll explain it over and over.

"I think it's easier to learn in a small school because we know all the teachers personally. I can go to teachers and easily ask them something. You can't do that in a big school. BRT has helped me to want to learn. We're on a friendly basis--person to person, not teacher to student. We call all of the teachers by their first name, but not in school. After school and out of school it comes easy, though more for girls than boys, I think. I don't want to move away. This is my school. I plug for BRT. This feeling is common, especially among girls. We always pack the spirit rallies. The feeling comes very much from the teachers' attitudes. They're not looking for trouble; they're willing to help us. Also the superintendent--he's good and fair and we respect him. Teachers here are friends to me, not symbols of authority."

George: A Senior

"Science and algebra and geometry are just teaching you to think, even if you don't understand. It imprints in your mind to use a process, to think for different situations that you come across. This is what I feel now when it's over and I look back. Sometimes you think you're not learning anything, but I imagine most kids see it that way. I do. A few never see it as any value. It sure won't hurt a person to know about science, because the more he knows the better off he's going to be.

"I took basic math. That's problem solving with multiplication, addition, subtraction, and division. Also algebra and geometry. They're still problem solving but they go about it with a different view or attitude. It's just not quite as apparent as basic math.

"Math--I couldn't get by without it. I use math all the time in farming and to a certain extent in all I do. For farming, you got to figure your percentage of food, fertilizer, seed, etc., per acre and the costs per acre. I keep a record of these things because of FFA, but also because I rent land from my dad. Algebra and plane geometry aren't necessary for farm calculations. If you have an irregularly shaped field and need to figure its area, then maybe plane geometry is useful.

"My dad, he requires us to take accounting and to take at least two years of math. There are other dads who also require their sons to take plane geometry. My dad never said anything about taking science courses.

"Math is probably more important in the future, than now. For most occupations a person plans to enter, a good knowledge of math is needed. I've got no regrets about taking it. I just wish I'd learned a bit more. Algebra seemed awful tough. I wish it were taught slower. Slow it down some. Use more examples. We'd get an example and then move on to the next theorem, but I think we'd be better off if before going on to the new theorem we had more examples of the old one. In math, we'd have an assignment of problems every day. We'd go over 'em in class. There'd be questions and he'd explain more. Then we'd get a new assignment for the next day which the teacher would explain before you did the new problems.

"I learned some, but not as much as I could have. I could have paid more attention, asked more questions. I thought about this all the time. Four people in the class had a good idea of what was going on. Seven to eight knew half way what was going on; I was in this group. Others didn't understand anything. We went at a fast pace. It seemed that questions would slow down this pace. The more you know, the better you feel about asking questions, and the less you know, the worse you feel about asking questions."

Steve: A Junior

"I'm taking technical math this year. I had modern math in my freshman year and no math last year. Mr. T., our counselor, said to hold off on technical math in my sophomore year. I'm sorry I did it this way because it was easier last year when students didn't have contracts like this year. The contract makes me work harder and faster than I can go. I'm not that great at math; I'm down to the C and D area. The stuff we're doing uses instruments that I never used before. I never was too good working on fractions. This stuff'll be good for carpentry, though."

Junior High Mathematics
Mr. C.: Junior High Math Teacher

Mr. C. has a gentle, kindly appearance, yet he appears firmly in control of his class in the terms favored by teachers in the junior high. That is, students are quiet and orderly, but not cowed by authority. They respond to questions, stir when a joke or gesture by student or teacher animates them, and are quick to settle down when Mr. C. quietly remonstrates with a "Get busy."

The eighth grade, as taught by Mr. C., proceeds by questions. "What is the perimeter?" "How should we carry on?" "What is this?" "How do you . . . ?" Mr. C. follows such an approach while working with the class as a whole or with an individual, his manner suggesting to the students that surely they know the answer. All problems are worked out on the blackboard, the class multiplying, dividing, or whatever, in unison. It's as though he decided that while the new math may give shape to the mathematics he teaches, he is committed to his students' mastering the four basic arithmetic processes. Loathe to discourage any student, he gives credit to students who give a wrong answer but seem to be on the right track.

When students have been assigned problems for the next day's class, Mr. C., in the time remaining, is on his feet until the bell rings. Like a bee darting from flower to flower, he moves from student to student as they announce their need for him by a raised hand. But he tells no one the answer nor exactly how he should proceed to obtain the answer. Rather, he asks, "OK, what is this?" or "Now, what should you look for here, the area or the circumference?" or "See, you've already got two-thirds of this right. Let's see what should be done next." His voice is always patient, warm, and supportive. As he moves about the room, the students either work alone or share their solutions with their neighbors.

Grade School Mathematics
Mrs. B.: Fourth Grade Teacher

"In math we have new books in the Macmillan series and we're basically following the order of the book. We've come to multiplication now, but the book assumes a background of multiplication that this group doesn't have. So I've arranged for the students to learn at their own rate. I told them they must rote memorize because they can't do complex problems otherwise. I use extra skills and games to help them master multiplication.

"Grades one and two have their own math series; it's very different. We only have our reading series in common with them. Grades three to six have the same math series; seventh and eighth may have, I don't know. The superintendent and principal hoped we would have uniform series for K-8, but it didn't work out. We had ten series to consider for math and we had meetings or workshops for about a total of three hours after each of us had personally examined the books and then made a selection. Grades one and two just did not want to adopt the Macmillan series, but their books are consumable so they can change them easily and frequently if they decide to do so.

"I have a feeling about math that I need to cover what they'll be getting to in the fifth grade. There's no particular relationship in social studies between the fourth and fifth grade. In science we do some of the same things because we both use E.S.S. materials. I've devised some of my own cards and Jane in the fifth grade will use the regular cards. Even in math, if I don't cover all that I could, I tell Jane what we didn't get to. I talk with her a lot and tell her about the students as a group and where we got to, but I don't bother in social studies or science. In social studies we use the same series in grades four and five, but the books are delineated in such a way that the kids are not handicapped if I don't cover certain things. And in reading, the next grade's teacher just begins where I left off."

Mrs. B's Fourth Grade Math Class

The signs of a new unit are visible throughout the room. One bulletin board is titled "Metric Madness" and "Going Metric," and another reads "Explore Space," ready for the new science work. It contains posters of space ships, astronauts, and sky labs. Beneath the bulletin board is a long table of books, all on space, rockets, and planets.

The rest of the room displays other exhibits: stretched over the front black board are four horse-drawn stagecoaches with letters of the alphabet on them, student drawings of castles in a Halloween motif, a globe, about twenty library books on assorted subjects, four shelves of reference books, each student's name and birthday on a 3" X 5" piece of paper posted on a back wall bulletin board, a tree branch, without leaves, with poems hung from the limbs, a student job chart, an animal cage with two guinea pigs in it, and a variety of large and small plants either hanging from the ceiling, on the floor, or resting on a shelf near the window. The date on the front bulletin board reads, "October XIII, 1976."

Mrs. B. takes orders for the noon and second recess milk. White or chocolate. She asks how many brought their lunch. Everyone turns toward the flag to pledge allegiance.

T: We will have a film this afternoon. These people will do the lights [she reads names], these the shades, these the screen, and these the projector. OK, if I'm gone, who would you prefer for a substitute?

S: Aunt Mary.

S: Mrs. McGill.

T: We've had no mothers volunteer for our Halloween party. If they want to, have 'em send a note.

Mrs. B. calls the students' attention to the new bulletin board containing different lengths in the metric system. She holds up a meter stick and shows strips one decimeter, one millimeter, and one centimeter long.

T: Anybody know the temperature this morning?

S: 70° F.

T: How much was it when you got up?

S: 34° F.

T: How much Celsius?

[A student goes to the front of the room to look at a pair of thermometers to make a comparison between Celsius and Fahrenheit degrees.]

S: Can I check how much 70° F. is? It's 22° C.

S: 32 is exactly 0° Celsius [one student calls out without being asked].

T: OK, we have here on the table different things you'll need for your metric work. I've got a trundle wheel that measures in meters. Be careful with it. It's plastic and will break.

S: We counted 96 meters from one end of the hall to the other.

T: OK, there are beans, golf balls, and popsicle sticks.

S: What do we use for measuring millimeters?

T: You need to use your regular ruler. If you use a ruler, be sure to look at the right side of the ruler. Now, I've divided you into three groups--one has a set of cards, another has a different set of cards, and another has a booklet. Keep a record for your whole group. One person should do this. At the end of the day I want to see what you have done. So for the next couple of days you'll be in metric groups. We'll have metric game problems on Monday. Any questions about the group stuff? OK, get pens and paper. Remember you need a secretary for your group.

One group goes to the rug in the reading corner. They follow a sheet called "Metric Search" which tells them to find a shoe, button, crayon, paintbrush, key, penny, and paper clip. They enthusiastically search for these objects. One boy smells the shoe he has collected and pretends to faint. Another boy picks up a ruler and measures everything within reach. Soon they turn to their collected objects. They measure three objects before someone recalls they have to write down their results. Billy insists that it is time for a new person to be the measurer. He re-measures the penny and the quarter and comes up with different results from the first measurer. They argue until Billy concedes that the answer is not one and two centimeters, but two and three respectively.

They go to the next card of instructions. Susan reads instructions that require her group to draw a page full of airplanes, cars, or motorcycles. The boys press successfully for airplanes, even though the girls insist they can't draw one. Tim suggests they each draw one plane and he demonstrates two different kinds. He then continues drawing, to the amusement of the girls, one small, one fat, and one skinny plane. Meanwhile, one boy has been drawing a serious plane all this time. He shows the group his plane and Susan says he should draw a page full. He eagerly agrees.

They move to the next card which asks for line segments of different lengths in centimeters--one, three, four, five and seven. They call out the lengths they want to draw, debating over who called seven centimeters first, the preferred length, seemingly, because it is the longest. After drawing their lengths, students follow the card that directs

them to make an imaginary picture using their already drawn lines. David prepares the picture, his group instructing him to draw a window, a flag, etc. They find the picture drawing amusing.

The next card calls for a "Smile Contest." They are instructed to measure smiles to the nearest millimeter and to offer an award to the student with the widest smile. They laugh as each of them pulls his mouth open, an index finger jammed into each corner, to the widest possible smile.

T: Are you guys writing this down now? You're supposed to keep records.

S: I won the smile contest [Billy announces].

T: Wait a minute, people. I don't think you understand. You're supposed to write down each person's smile and its length. We'll be stopping soon, so don't start another card.

S: Where is my smile award?

S: It's one kiss from Jackie Brown.

S: Or you can eat my eraser.

Mrs. T.'s Second Grade Math Class

Mrs. T. writes these numbers on the blackboard: 4, 5, 9
6, 2, 8
5, 5, 10

T: OK, now, let's see. We have nineteen people here today. Let's kind of group up to have some teams.

S: Yeaa [they shout].

T: OK, what do you want your teams to be? What's a good Halloween name? Tim?

S: Jack O'Lantern.

T: OK. [She writes the team's name on the black board.] Diane's team, come over here on this side of the room.

S: We'll be the Ghosts.

S: Shucks.

T: Remember, we don't help. I'll give you the two addends and the sum and you give me the facts . . . .

S: 3 + 4 = 7. 7 - 4 = 2..

S: Nooo.

T: You can't give hints. I don't think we count that because Diane spoke up.

Diane, you'll have to learn. You caused your team to lose. OK, Doug.

S: 5 + 2 = 7, 2 + 5 = 7.

S: Can't hear him.

T: Turn your TV up a bit. Don't help him. Can't wait too long. Now your subtraction. Shh, shh. Hands down people. C'mon Doug, can you do it? OK, no score yet. OK, Susan.

S: 5 + 2 = 7, 2 + 5 = 7, 7 - 2 = 5, 7 - 5 = 2.

T: Right. This is a score for the ghosts. [Students applaud.]

T: It's all yours, Brian.

S: 1 + 9 = 10, 9 + 1 = 10, 10 - 1 = 9, 1 - 10 = 9.

T: No hints. Let him think. No, remember with subtraction facts you begin with the sum. Tammy.

S: 3 + 2 = 5, 2 + 3 = 5, 5 - 3 = 2, 2 . . .

T: Somebody is whispering.

S: Two take away.

T: Your last subtraction fact.

S: 2 . . . 5 - 2 = 3.

S: She made it, didn't she?

T: That's a score for the Jack O'Lantern.

SOCIAL STUDIES IN BRT

Some form of social studies is taught in each year of BRT's four-year junior high school. In high school, however, students can graduate having had only one year of work in this area--the state-required U.S. history. This follows a year of U.S. history in the eighth grade which is not coordinated with the high school course. Coordination, if desired, could be difficult given the disposition of the junior high social studies teacher to emphasize those topics of strong personal interest.

As noted, high school social studies, unlike math and science, has not been taught by any one teacher long enough to establish it on a firm basis. This year, Mrs. F. teaches U.S. history and sociology. English is her major subject and she has not taught social studies, her minor, for five years. The sociology class presented below has the reputation of a catch-all for juniors and seniors merely looking for a course to take. The impact of this reputation and lack of continuity appears in the reactions of Bill, one of BRT's most able senior students: "My interest [in social studies] never got built up in the first place."

Throughout this section there are several references to the limited background and consequently narrow outlook of students in this rural community. By the time we reach the comment of Mrs. T., second grade teacher, it seems established as a general view of BRT's youth. She observes, in reference to her focus on understanding types of work, that, "Kids don't realize there are so many ways people earn a living." In short, the rural community, according to local teachers, provides a limited range of outlook and stimuli, and student awareness shows the impact of these limitations.

Mrs. F.: High School Social Studies Teacher

"All together I've taught seventeen years--nine years at a few different schools and eight years here at BRT. I'm in my ninth year now; of course, there was a ten year gap before coming back to teaching here when I was mother and housewife. During those years, I had it in mind to return eventually. I have three boys and I felt that I'd like to see them have a little better education. I knew if they did I'd probably have to contribute to the finances of the family. You know, it's a must, and it's a shame . . . sometimes I think, well, I enjoy my work. I don't feel like I have to work, I enjoy teaching, but so many people work because they have to.

"Now my sons are mostly grown up. Only one is at home and he's a high school senior at BRT. Still, we lead a busy life. We've always tried to maintain close family relationships; and between my family and my husband's, we've got nine brothers and sisters within easy driving distance. But I'm also an avid reader. When I wasn't teaching and before my children came along I could devour ten books a week, easy. I prefer something along the line of Gone With the Wind. Right now I belong to a book club and I've got a row of Reader's Digest condensed novels that I haven't been able to get to. We subscribe to several magazines, Reader's Digest and People, and to two Champaign newspapers. It seems like during the school year I'm so busy I never find the time to do things I want to do. I get up early enough to watch the morning CBS news and at night, well, I almost hate to say this . . . I read this article by Art Buchwald about President Ford's TV tastes, and I know it was tongue in cheek, but I guess I have the same interests--whodunits, situation comedies, that sort of thing--as President Ford. When I watch 'All in the Family', I either see myself or somebody I know. That's such a beautiful mirror, really. Otherwise, when I finish my work in the kitchen, I'll go sit down and watch what my son is watching. Of course, I have my circle group from the Methodist Church, but that only meets once a month. We're trying to get some men to join us, though it's still mostly women and the minister. We study different

books of the Bible. Like next week I have to start preparing for a lesson on the Holy Spirit, which is rather a deep subject I'm not sure that I'm up to. The last one dealt with the Book of James. At any rate, this is something that I enjoy. I've tried different organizations, but I never felt like I took enough away from them to merit belonging. You know, in a small town we get involved in petty interests rather than in what I consider constructive. Meetings turn into gossip sessions. Many of the ladies will meet downtown everyday at ten or two the year round. I won't do that even during the summer when I could.

"Summer's a good time to catch up. I can do a lot of the reading I've been saving. Probably the first month I spend cleaning all the things I've let go. Then we try to take a little vacation. Nothing extravagant. And I'll spend time getting ready for school, if I know what I'm going to be doing. This past year I wasn't sure whether I'd be in English or social studies. Ordinarily I look for articles, bulletin board material, and this type of thing. I try to do some planning, though just at my leisure, really.

"I'll visit my mother a lot during the summer. She lives nearby. Just recently she's stopped working. Been making custom draperies for years. Dad was a tenant farmer and he died four years ago. We weren't rich by any means, but somehow my mom came up with the money and all of us got vocal, speech, music, or elocution lessons. Eventually, three of my sisters became teachers and I went to Illinois State to study speech and dramatics. Social studies was my minor. I had a high school teacher I was very fond of and hoped to emulate. She was in speech and I was involved in all the plays and speech and contest work.

"What a lonely year that first one at college was! I'd never been away from home before. I'm amused when I hear the kids around here say, 'The day I'm eighteen or the day after I graduate, man, I'm going to get out of here.' I probably felt the same way. I learned that these small towns are pretty good places when you're gone. I stayed at Illinois State till graduation and then came back home to look for a job. I was engaged when I graduated and my husband-to-be hadn't gone to college.

"I felt like I was prepared to teach when I graduated, especially after my practice teaching. That was the best part. I really wasn't interested in all the education courses I had to take because to me, they didn't sound practical. You'd learn things that were maybe good in theory, but when you got into the classroom, it was another ballgame, like in the area of discipline or motivation. I've heard other people remark, 'Well, so and so wrote this book but I bet they never taught five days.' I suppose, though, there are some basics that need to be taught. Still, when you're eighteen, nineteen, or twenty, you'd like something a little more exciting than philosophy of education. Now I see this as a necessary course; you have to have a base. Whatever it is we're going to do, we need a base for it.

"One summer I returned to school for a health education course. The school I was teaching at wanted me to prepare a curriculum in that area. Now if I were to return to school I think I'd like to study social problems, sociology, something in my minor field. I think there's a need to understand certain social problems like alcoholism in teenagers, drug problems, divorce. The idea of divorce still upsets me. I'm sure I'm a minority there. Premarital sex--this is completely foreign to me. My parents were very strict. How strict they were in the forties! Oh my goodness! I'm just not liberal thinking along that line. I fully believe in the sanctity of marriage. I'm not sure young people nowadays feel this way. It's incredible to me that a couple could be married and a young lady would choose not to take her husband's name. I've had students ask me before what I'd do if one of my sons had a mixed marriage. My response is, I think I would react this way, 'It's their choice.' I figure when they get to be that . . . . These problems do not touch my family. At the same time, these things are happening; they're terrible, and you never know, they might come home.

"There are so many times that someone will come up with an idea that to me indicates they aren't thinking logically. This happens right in the classroom and I feel almost compelled to straighten them out. At the same time, it's difficult to do this without enforcing your own opinion on them. I really prefer an informal type classroom. If somebody comes in and they are really uptight about something they have seen or done, well, forget the assignment. If they are ready to discuss it, and I can see the interest, we may blow the whole period. It doesn't bother me to change my lesson plans. They may get more out of that than what I had planned anyway. The things that go on here on Saturday nights outside of school eventually get to school and sometimes you're forced to deal with them.

"My subjects, both English and history, are required and I probably wouldn't have a full classroom if they weren't. Anyway, I think I really have something to contribute to students. I have to keep reminding students why they have to take these subjects when they tell me they won't remember all this or that. No, they won't remember those things. So I usually say if you can take any assignment that I give you, do it to the best of your ability and complete it, then you have accomplished something. You're learning something about responsibility and about following directions. These are things you're going to have to do when you get out, going for a job, whatever. I'm sure that explanation falls on deaf ears sometimes, but that to me is what it amounts to.

"For example, in almost all my classes I require some kind of research paper. I give them a set of rules: you must use at least three references, you must keep note cards, you must meet deadlines. Following a given set of rules--it's hard to believe that students don't realize the importance of that kind of thing. This is one of the things, aside from the subject matter, that I try to do. I've always tried to be very careful not to make my subject matter appear to be more important than what they're taking in any other class. This is unfair to students. I've taught with teachers whose requirements for students were above and beyond what they should be.

"I think we all have to keep to the basics. So far as I'm concerned, it's essential that students have some general knowledge about their background. Thus, history, you see. But I don't believe in committing to memory dates and places, things that we cannot show are relevant. If they can catch the general idea of what the country was like in a particular period . . . It's enough if they can say this is the way things were and these are some of the reasons for it. Then they should be able to relate those things. What I'm trying to do is bring the past up to the present, I guess. It's a matter of seeing relationships because facts aren't anything by themselves. Too often they learn something for the moment with no carryover to it. I suppose this is part of what I mean when I say 'See the relationships,' seeing something relevant to tomorrow's assignment and what we had two weeks ago. There's a thread. It's almost like the plot of a novel running through all this. Yet, so many of them, what they learn is for a test.

"I don't think I resist change if it can be shown to me to be of value. I'm not different from anybody else. Sometimes it's just inconvenient as the devil to change. It all depends on what you're accustomed to. I don't think the parents are urging us one way or the other. I seldom ever talk to parents unless I've sent home a failing notice. We don't have a parent-teacher organization. My husband's a mechanic and sometimes he gets in a young man and he'll comment that we need to teach these kids how to read directions. But our communication with parents is extremely low. Either they're quite satisfied or they don't know what's happening. I don't believe I teach in response to any particular way I think the community feels. Still, still I live in the community. That's different from people who drive in everyday. I know how parents feel toward the school. They're proud of it. One day a boy came to class with a copy of Catcher in the Rye saying he wanted us to study it. I hadn't read it so I secured a copy, read it, and said no to using it in class. I said there has to be something better to study. I realize this book is supposed to be some kind of psychological study in the maturation of the boy, but somehow I would not have been comfortable with it. And I don't think some of the parents, if they were to

pick up the book at home, would have appreciated my using it. I found the language offensive. I told the class that whatever I bring into the class for study has to be what I consider good literature. But parents have never called to complain. If our discussion of capital punishment didn't do it and abortion didn't do it . . .

"Right now students are only required to take U.S. history in the social studies area. We're so downed by schedules it would be idealistic to think there's room for another required course in this area. But if I could require one course, it'd be sociology. If it's well taught, if it's well received, some of biggest problems are there--crime, war, delinquency, the social problems. And a study of those social problems might stimulate some of these people into social service. And to me that's where it's at. I know there's always been problems, but I'm a confounded optimist.

"Our students have to think in terms of a world a little larger than this community, so far as problems are concerned. We had this film the other day in sociology, Black and White Uptight. A good film on the race issue. The class didn't want to discuss it. I could see them shrinking--'Oh no, not that again.' I said, 'Well, I have only one comment to make. I want you to consider how well you would survive if you had to walk in that Negro's shoes for one day.' The film showed the mother not having milk for her babies, only sugar water, the rats, the hanging plaster. And to the students . . . I can understand the opinions they've gotten at home. They're simply repeating things they've heard. I don't know. The sociology class has twelve students, most of them seniors. Mostly, they're slow students. They were looking for a course with a minimum amount of work. They're not interested in facts. They have opinions but won't go to the trouble to back them up with research. The one thing they're looking forward to is graduation. Makes you wonder about compulsory education. I'm from the old school--you must have a good education if you want to get anywhere. I don't know about this when we have kids here whose achievement level is in the seventh grade and we require them to come and sit in school five more years. When you see them in your classroom you wish that rather than force them to come here and sit day after day and sleep, too bad you can't do something else for them. Some of the seniors look forward to only one thing and that's graduating in May.

"At any rate, here's what I'm trying to get across in the sociology class. First of all, that you, the student, you're a member of the group. You have a responsibility to the group and you should never consider that your contributions toward class discussion, toward group activities, is not important. I'm trying to get them to see the fact that they are part of the whole and what they do affects someone else.

"Now this week I have three days of discussion set up. I was loused up one day because the seniors were gone all day and when I made out my plans I didn't know this. I gave them an assignment to interview three people as to what they consider the merits or disadvantages of Little League baseball and Pee Wee football in regard to youngsters of that age being involved in competitive sports. Then another day I want to take up with them this idea of cooperation in a dictatorship as compared to competition in a democracy and then branch out into how the individual is affected by the group and vice versa. Whether or not they'll do these assignments, I have no idea. I'd say that probably three or four will maybe take the trouble to interview someone.

"Another idea that I'm doing is competition in American students scholastically and athletically, whether it's good or bad, what kind of problems does it create. I'm interested in seeing what they'll do with this question of dangers and rivalry between nations, which is all a part of the competitive area. And whether or not they'll be willing to discuss the idea of nuclear arms race or if they're aware of what the results of competition in this area could mean--catastrophe for all of us.

"So I'm concerned with the individual's place in a group and with competition. I feel I have to relate them to something they're familiar with. That's how I come to Little League and school events.

"You know, I kind of get the feeling that this tune of anti-establishment is still with us, though maybe not so much as a few years ago. Students just aren't too sure that we oldsters have much to contribute to them, that we don't understand them. The one thing that is probably nearest and dearest to their hearts is working. We don't just release them from school for work. They must notify the school ahead of time, have their parents' permission, and get the assignment and make up the work prior to their being gone. This is new and many of them resent this. Always before if daddy was ready to pick corn they'd stay home for three days and then come back and pick up where they left off. And I've heard different ones say, 'Why can't we graduate in the middle of the year like they do in big schools? Then we could get out and get a job before the summer when everything else is taken.' Well, I never did feel like emotionally they were ready, they were mature enough. I can't imagine them at seventeen or eighteen out on the job market. So this is one thing we've discussed. Why did we change the rules? Is it just another old rule? So this is why I feel they're kind of down on the establishment. I hope that by the time they finish they'll understand that society is built on some kind of rules and regulations and they're there for the purpose to protect you, not to antagonize you.

"But this is one area I think kids have changed since I began teaching. Back in the fifties they would not question a rule. Now they question every rule. Young people do not respect authority as they used to. They question why is this necessary; perhaps they question many more things. A good example of this is the draft. Look at our evaders and deserters that we're still fussing about now. 'Why?' 'You can't force me to do it.' It's almost as though we have to prove why we're here, why we're functioning. 'What makes you think you have anything of value to teach us?' You know, I get the feeling many times that I'm on the defensive as a teacher. It isn't enough that I stand up and say, 'This is your assignment.' I almost feel as though I have to prove it, to prove that there's value in doing it, other than the fact that I just want them to do it.

"Sometimes they really surprise me. I expect to get a spark from a particular topic and I strike out. The other day when we were discussing collective behavior I thought I'd get some interest in Adolph Hitler because the book discusses how he used a knowledge of collective behavior to get what he wanted. I expected more questions, more interest. Hitler is removed from them and yet not so far. Patton was on TV the other night.

"Another thing is I think they're less competitive scholastically than they were even three or four years ago. Students don't seem to mind if they're not on the honor roll. And I don't know how much parents mind either. There's the idea, 'Why should I go to college, spend all that money and time, and maybe not find a job?' Gee whiz, there's a lot of teachers out here without jobs. A year or so ago there were all those engineers laid off. They're selling hamburgers or something. Students say they can go out and lay bricks for eight or nine dollars an hour, so why should I go to school. Whenever I say anything in class about getting your diploma, somebody's always ready with an exception to the rule. They know a guy who's making X thousands a year and of course didn't graduate.

"One thing that hasn't changed is grades--students don't like to get them and I don't like to give them. I don't brood over them but neither do I feel that I can just follow test scores. So I probably spend more time on grades than maybe other teachers do. I don't want to over- or under-evaluate. There's so many things we don't know in regard to the background of a child. The emotional level of the family, what things are like at home, what kinds of responsibilities . . . As far as I'm concerned these things affect the child. One boy slept all the way through class the other day. I don't know if he didn't feel well or not. Now this is frustrating to me. And yet so many things I find it better to ignore. We'll see if he sleeps on Monday. If he does, I'm in trouble.

"At any rate, I like kids. I like the give and take between students. I enjoy observing them in the halls between classes. And if you're in a place more than four years you can see them grow physically, mentally, and socially. I get a lot of satisfaction out of teaching or I wouldn't be here. For maybe ten years more I'd like to teach and then do other things. Maybe travel, or just sit around."

High School Social Studies Classes

U.S. History

On the blackboard, Mrs. F. has written: "Amnesty in 1863 and 1968-76 and voting qualifications for blacks in 1863 and the poor qualifications of minority voters today."

T: How many of you favor full pardon for those who went to Canada to avoid being drafted at the time of the Vietnam War? [No hands are raised to answer the question.]

S: What happens if we don't give them a full pardon?

T: I'm not sure, Marie, what would happen if they decided to come home. Maybe they'd be jailed or have to follow a rehabilitation program. My reason for asking is I hoped to find someone who felt strongly about their return. I hoped to come up with a good debate. Now, are any of you willing to take that viewpoint? [Students talk to each other but nobody appears willing to do so.] I'm not so well-versed on this topic. Marie, will you do a little research for me? What does President Ford believe about this? [Marie agrees to do this investigation. The boys in class seem to be agitated.] If any of you were of an age to face the decision of Vietnam maybe you'd feel different than you feel now. [The class is silent.] Marie, have it ready for Monday, please. Hopefully, some of our films will be in Friday or Monday.

U.S. History

A film is to be shown during this period. Mrs. F. opens the class with a long introduction that suggests the Civil War is not over yet. She tries to connect yesterday's reading about the post-Civil War period and today's film. The film is about busing primary-school-aged blacks to a white school and parental reactions to busing.

When the film is over, Mrs. F. asks, "What do you think about the film and the issues?" There is a long silence in response. Finally, one boy says, "The film was OK." Then Randy, a newcomer to the school district who attended an integrated school before moving to BRT, describes his previous school. "We had thirty percent blacks in the school but I'd say only two percent mixed with the whites. We had near riots a couple of times. There were black tables in the lunchroom. They did their thing and we did ours." Again, the students respond with silence.

Mrs. F. comments, "I was amazed at the ignorance of the adults in that film. They had such poor manners and no social graces. I don't expect to see the problem solved in my day,

but some of you might live elsewhere, not in BRT all your life, and you'll have to understand and make decisions about these issues." As the period ends, Mrs. F. passes out homework papers and reminds the class about their exam tomorrow. Randy is taunted by some joking questions about his former high school.

After class, Mrs. F. says that her students lead such sheltered lives. "Many will graduate and go live on farms out there." She points to the fields that surround the school. "I get so frustrated at times trying to reach them. They seem so disinterested. Maybe they feel more than they let on."

Sociology

Mrs. F. begins reading from the textbook. The topic is explanations of cultural variability. Harry reads next. The other students sit quietly and follow along with the reader.

S: Is that far enough?

T: Please continue. . . . OK, this tells us that geographic factors do not explain cultural variations because we find different cultures in the same geographic area. . . . [A student asks a question about some point in the text.]

T: I don't know. Why don't you look that up?

T: Jill, will you read?

S: I can't.

T: Sure you can. Try.

S: I know I can't, so why should I try?

T: Sure you can, Jill. [Jill reads and does quite well.] Thank you, Jill. So it has a contributing effect, but does not explain the whole thing. Are cultural variations a product of race? Patty, would you like to read? [Patty reads.] So we cannot rely on race as an explanation for why cultures vary. And geography's not the answer. All right. Let's see what follows. Ed, will you read? [He reads.] Tim, please read.

Tim asks Mrs. F. why in yesterday's class she compared Australian aborigines with bones in their lips and Americans chewing gum. She explains that using bones is what Australians do and chewing gum is what we do. Tim stops reading after he is too frequently corrected by the boys on either side of him. "I don't feel like reading no more," he says.

T: So we didn't find a specific explanation. Elements of chance are to be included along with geography, race, etc. OK, a question for you. What effect has geography had on development of culture in your region of the U.S.? OK, what do we need to consider to answer that?

S: Surroundings?

T: Including . . .

S: Food, water, climate.

T: OK

S: *Uhh, the way the ground is. No mountains, things like that.*

T: *Now in what way have all these things affected what we do here?*

S: *I don't know. That we farm. [Harry says diffidently.]*

T: *Yes, this is a farming region. What I'd like for you to do is try to determine in the village of Rhodes which businesses are farm-related. It's interesting to find out how many people are in businesses other than ag-related ones. Think of your neighbors.*

S: *They're retired.*

T: *We have people who drive to Champaign-Urbana and Rantoul. Do a little checking on your own for me, OK. Geography can exert only a limiting effect on cultural development. I think we'll carry on here. David, would you read?*

Sociology

T: *We're going to have a test on Tuesday. You'll need to study very hard for it. All the terms in the chapter will be on the test. You should know something about them from class. [There is much student talking. Some of it is boisterous. Mrs. F. remains perfectly calm.] Leaf through chapters three, four, and five. See if you have any questions. This will amount to a unit test. Our next unit is on the group and the individual. I plan to hand out another text and we'll use two of them together. We'll find examples in one not in the other. It'll be of great interest to you.*

S: *Do we need to know all the words? There's about a hundred of them.*

T: *Part of your problem may be you're not attentive in class.*

S: *How're we supposed to memorize fifty definitions?*

T: *It'll be an objective test so you'll be able to use recognition. OK, I had the librarian bring us books from the library in hopes you'll find something for your research project. For example, the Japanese in the United States. Also books on Negroes, on protest, and man versus society. There's been a lot of this in recent years. Why the protest? Do people gain what they're hoping to get? We've got books on crime, overpopulation, Jews, Puerto Ricans, dignity in death. So I want you to think in terms of possible topics. You can use these books, but only in this room. (All the students are quiet, listening to Mrs. F.) The first half of the quarter is over and we'll do these projects next. Today I'll change the plans a little and not get into the new chapter. You can study, since it's Friday, and you can go through the books I have up here. . . . How many heard the Ford-Carter debates last night?*

S: *I watched 'em come on and go off and slept during the rest.*

S: *Boring.*

S: *The best part is when the sound went off.*

T: *Don't you think there's much to be said for enlightened citizenry?*

S: *I don't want to know that bad.*

T: *I was impressed with both their presentations. From what I'd heard, if I hadn't made up my mind, I wouldn't have been able to decide after last night. Both did well.*

S: *By the time it was over, Carter was hurting pretty bad.*

T: *You think so?*

S: *Carter's got that smile. I like him better than Ford by a long shot.*

Mrs. R. does not respond to this observation. She walks over to a student to help him select a book. There are five boys sitting at the back of the room, somewhat apart from other students, engaged in increasingly animated discussion.

S: *Blacks are afraid unless they're in groups of three. One alone'll never fight. Jigs are a bunch of bums, anyway. Hate 'em all. I never saw one I liked.*

S: *You're a racist.*

S: *So am I and there's nothing wrong with it.*

S: *Yeah, nothing wrong with it.*

S: *They're stupid.*

S: *No, they're not.*

S: *Let 'em go right back to the jungle.*

S: *They sit back and collect all that welfare.*

S: *I think you ought to shut up.*

T: *I don't mind if you discuss something current if you use logic. This is not constructive.*

S: *We keep 'em alive.*

S: *They got the worst end of the deal. The rip off.*

S: *Yeah, they collect food stamps and drive Cadillacs.*

S: *They shouldn't get to go to school free. That's why there's so many black athletes now.*

T: *I don't think you're getting anywhere.*

S: *I never saw one with a good education.*

S: *We drove 'em from it.*

T: *I think a debate would be fine but we need to establish some rules. OK, we'll set one up. If we have a debate, you'll need to do research. Get some facts. Not just your opinions.*

S: *We went to town the other day and heard this old black bum complaining about her welfare check.*

T: *Maybe she had obligations.*

S: If it was a white person, he'd take care of the thing himself.

S: She'll just go home and sit in front of her color TV.

T: Tim, we'll close this discussion now.

S: Can we have a panel discussion among us four?

S: I want a boxing match.

T: Tim, consider it closed till we get guidelines. We can't start on Monday 'cause we've got other things to do.

S: I'm ready right now.

Mrs. F. goes to another part of the room to continue helping students select a book. The boys at the back of the room continue their verbal sparring.

Sociology students are tested regularly. Their first test of the semester appears as Appendix E. It includes the mixture of objective and subjective test items that Mrs. F.'s tests usually contain. She always includes several essay questions, though many students will respond not so much with an essay as with several lines.

High School Students' Views of Social Studies

Steve: A Junior

"U.S. History, it's about events that happen in the past, people doing things that we're still doing the same things today. All we're talking about now is industrialism, the big industrialists. Back then they paid people little, fired you at the spur of the moment, and you worked long hours. Now it's better. You can talk to the boss and you don't get fired without speaking your piece first.

"We studied immigration, how people like the Chinese, etc., came over here and took jobs for less money. They also used child labor. I didn't like immigration; those people shouldn't have been able to come. They took out jobs. If they did not get jobs, the immigrants went to live in slums. I got this idea about immigration from the text because those people did not stay at home to settle their problems.

"In history we read, see films, get notes from the teacher, talk and take tests or quizzes. I'd like to see more films. We saw Jazz Age, but it was not on the subject we were on at the time. The book was better than a film in this case, but people pay more attention to films. Lectures get boring. Films have some funny parts and the class is funny only when students make jokes. We learn more from films. It's not over our heads like some of the language the teacher uses.

"When we have discussion, the teacher is wanting to find out if we read the chapter and looked up the words in bold face print. Those usually are on tests. Also if we understood what we read and can recall the facts. Our books are open when we do this. She always asks questions from the back of the chapter and some from the top of her head. And she'll ask our opinions, like what we thought of immigrants or the Pullman strike. We also

have essays to write on tests, but essays are worth not more than ten points out of one hundred total. You don't have to go to no great deal on the essay. It just takes about a paragraph to sum up what needs to be said.

"What I liked best last semester in history was the voting, the mock election. We had to really work together. We got experience to know how to vote. It was fun. For electing class officers, you just raise your hand, but the presidential elections took the whole day. We all participated, not just one person doing it. In anything else in history, just one or two people are always answering the questions. Here, we all helped.

"In class, we read what we're supposed to, at least occasionally. Nobody does too much in history because most think it's boring. You go through the same routine. When the teacher asks how many read the lesson, only one or two raise their hands.

"We thought the section on the gold rush was interesting so most students read it. I read that chapter. It was interesting because people went so crazy to get the gold. That was dumb; they should have shared.

"Before a test, I look into the chapter, flick through the headings. You have to read the class notes because you couldn't pass the tests otherwise.

"What I'd like to see in class is debates, because people got different points. We ought to get practice tests before the real tests so we'd get more involved. Current events in class would be a good thing, too. Divide up into teams and use a newspaper that has questions we could answer, like one-pointers or two-pointers. We got more out of history in junior high. We all read the paper and watched the news all the time. Now we only read the sports. In junior high we chose up teams at the beginning of the year and the winners drank pop. The teacher always showed us the other side of things, like if the immigrants didn't come here what would have happened. And everybody read All Quiet on the Western Front. We all paid more attention in junior high in everything. Things have changed now. Teachers just want to get rid of you to get you through high school. They figure you know when you don't know. We all participated back then. Now we've lost contact with teachers. Maybe it's a generation gap."

Tammy: A Junior

"Next year I'll take sociology and psychology. I need them because they're useful for being a psychiatric nurse. Any course I take is for my own personal interest or for college. In U.S. history this year we're studying about the changing course of our country. That's what U.S. history is about. About people. It's the same for any history--the way a country is and how it grows, the patterns of society, the way it integrates with the world, how different groups come together to make a nation (like the melting pot in the U.S.), and how a nation needs to change to fit into a changing world. It's a useful course because we learn more about people, why they behave the way they do. For example, learning about the persecution of blacks--this helped me to understand blacks today.

Bill: A Senior

"Ever since I entered high school, I always had a full schedule. No free periods. This year I'm taking two sciences. Took industrial arts last year. Never considered taking sociology or psychology. I don't know, it concerns your everyday life, but I never

placed too much emphasis on it. When classes I thought were more important became available, I never gave the others a thought. My interest [in social studies] never got built up in the first place. Of course, I had to take U.S. history. I had a bad teacher [Mrs. F.'s predecessor]. He's gone now. The class was a rehash of junior high stuff. It was just something I had to take.

"In the past year or two I've heard talk about consolidation around home. It is a definite possibility with enrollment going down. My family is strongly against it. Students talk about it quite a bit. We're privileged to have a school like this. We think of ourself as the cream of the crop around here. It's a pretty good school. It's the cleanest and most orderly. I like a school that's small and nice, without destruction. There are advantages to a small school. Small classes mean teachers can put more emphasis on learning and learning right. Here teachers can afford to make sure you're getting it, especially in chemistry, physics, and math. It's no problem to see a teacher to get help. We only touch on trig and calculus in senior math, but maybe it's better to touch on it and get it, than to take a whole class on the subject at a larger school. Sure, everything's not perfect. Probably U.S. history is the worst class I ever took. I learned something, but I didn't enjoy it. He mispronounced words; that was a standing joke in our class. He lectured for the first nine weeks right from the book, and he acted like he hadn't heard about the things he was teaching about."

Junior High Social Studies -
Mr. J.: Social Studies Teacher and Junior High Principal

"Here in the junior high we teach geography of the U.S. in the fifth grade. Then it's Latin America and Canada in the sixth grade, the western hemisphere minus the U.S. We use an outdated book for this, good on geography, but poor on current events. Seventh graders study world history. The urban revolution is the theme of the book. Kids don't seem to appreciate world history. And we finish off with U.S. history, which is what I teach.

"I don't know how Mrs. F. over at the high school does it, if she teaches pre-or-post 1865, but I don't get past World War I. I don't really follow the book. We go right past the colonial period, skipping the first two hundred pages. However, we do spend about two months on the Constitution. This is important; if you learn to play a game, you have to learn the rules. The Constitution fascinates me, especially since the school law course I studied recently. I bring in case studies on constitutional law and also recent ones like the Tinker case in Des Moines.

"What I try to do in this course is to get 'em to think a little. That's the hardest thing. We don't do a whole lot with memorization. Now in the first half of the course I emphasize the build-up to the Civil War. 'Keep this in mind all the time,' I say to the class. Then about one and a half weeks on manifest destiny--what it is and was it right. I ask them to put themselves in place of people and think how they'd feel if they were run off their land. Kids relate to the Civil War. They don't understand slavery. There's a hell of a lot of prejudice around here. Students read how slavery is a good thing in one handout and then in another they read a Southern industrialist saying it's bad for the economy.

"The kids are more open than their parents. I think they're more open than they were six years ago when I came here. Kids have to learn to understand why they believe what they believe and also how their beliefs are a reflection of their parents. I've been criticized by parents and also by a board member who thought I was criticizing Catholics. Once I asked a kid to explain the confessional. His father was furious with me.

"There's a few major points I try to emphasize whatever we're discussing. First is that if you understand what came before, then you'll understand what's happening today. Second is to be open-minded, about different people, religious, and political systems. I also got into hot water on that. I've been accused of being a communist and an atheist. Once the science teacher and I brought our two classes together to discuss Darwin. We were studying the twenties in history and talking about the Scopes trial. A few periods later a kid came by and asked if I was an atheist. These students are riled by a discussion of evolution. There's many fundamentalist Christians around here. Kids asked us if we personally believe in the theory and we had to say yes. They don't understand that Darwin was still a Christian even after developing his theories. Recently people from the Gideon Society came in to make a presentation of little Bibles. They got permission from the Board. This isn't right. What about the rights of the minority? Anyways, another thing I emphasize is an understanding of freedom and responsibility. The two go hand in hand. Freedom is always qualified; nobody's got it complete and total. Personally, my own philosophy is very conservative, especially about the expansion of money. I never could understand Keynes. I think both people and governments should live within their means. The last thing I push at 'em is the human aspect of war. Today kids seem to be getting back to the bang-bang stuff like when I was a kid. They were playing a shooting game at recess yesterday. In history we'll spend two weeks on All Quiet on the Western Front. At one particular point in the novel I've shot off a starting gun for dramatic effect. I've always hated war myself. I was drafted but never went to Vietnam and kids now don't even know about Vietnam. My ideas were shaped in the late sixties."

Grade School Social Studies - Mrs. B.: Fourth Grade Teacher

"Rural kids have a different experiential background. A fourth grader here is like a third grader in Champaign. They are not aware of places and differences in people, in culture that even a small city like Champaign has access to. All kids here have had very similar experiences and have the same way of thinking through things. Even in regard to kids' experiences with older kids--they're with the same kids from kindergarten on up. This is a limitation of rural schools. The students are not used to differences of opinion and different kids. It takes a new kid a longer time to get accepted. Here it is safe and not so worldly.

"For me, social studies is of middle level importance. Reading and math are ahead, but science is behind it because I'm not as good in science as in social studies where I do lots of map work. Kids have no concept of where places are. We have a text, but I haven't used it yet. The name of the text is Exploring Regions from Folletts. I also emphasize how to read maps. My husband is making tapes on little known countries like Andorra and Monaco. He also helped me prepare the map units. This year I'm working on interests, what interests the kids. For example, deserts--what they are interested in knowing, the animals, the location, etc. They can work on things of interest which they list, I list, the book lists. They'll work in groups and singly do a research topic. They'll make things--animals, deserts, etc. They like making things, but I also want to develop their research skills so they give oral reports. During the recent space unit, students asked very good questions, and if the group did not know the answers, they were very willing to locate them.

"One unit in our social studies book is on government and we'll probably hold an election and organize ourselves as a legislature to make laws. We did this last year and it went well. I was the president and had a veto. They made laws about free time, organizing a party, etc. After space, I went to a unit on light based on the text. The students are fighting the idea of the whole-class-as-a-group thing. They liked the space unit very much and are rejecting the way we study light, the whole class all together.

They like hands-on activity. They like to learn for themselves. I don't like the whole group thing either. When we get to sound and the water cycle I'll find out what they want to know and also use E.S.S. kits. I want to try learning centers, for example, with sound. All will have to do it at some time and those more interested can do more. I tried the idea in English and the students loved it, though it wasn't too flexible because it was skill and not theme-oriented like science learning center would be. We'll try learning centers in social studies, too, but I'm not ready yet."

Mrs. B.'s Fourth Grade Social Studies Class

Mrs. B. instructs her students to leave their groups and return to their own seats. She collects the records each group has kept. "OK," she says, "now you've got to switch gears." Several students make a gear switching noise.

T: Table two is ready. Robert's ready. Everybody's ready. OK, switch from measurement to talking about the globe. [She holds up a globe.] This thing around the center of the earth is the equator. Is it really there?

S: No.

T: What does it split the earth into?

S: Hemispheres.

T: Which one are we in?

S: The western and northern both.

T: [Mrs. B. leaves her desk to pull down some maps.] If you can't see, come and switch your chairs to the front. The maps here show the eastern and western hemisphere. Here's the equator. Right? OK, here is Antarctica. What hemisphere is Antarctica in?

S: South.

T: Yes, because it's below the equator. Another one?

S: Eastern.

S: Western.

T: Can everybody see the Indian Ocean? Who can tell me what hemisphere it's in?

S: Southern.

T: Yes, because it's below the equator. One more.

S: Eastern.

T: Is it above the equator?

S: Yes.

T: Yes, a little bit; just a smidge. Let's check out Africa. What hemisphere is it in? Jim.

S: Northern and southern and eastern.

T: Yes, because it's above and below the equator.

T: What ocean is in all four hemispheres?

S: Pacific.

T: Another one?

S: Atlantic.

T: I think you've got this down well. There's a couple of questions on the worksheet about hemispheres. If the question is "N.A. is blank of S.A.," start with the second one. Remember. Save yourself a hassle. Do it the easy way. Start with the second one. If I said, "Africa is blank of Australia . . ."

S: South.

S: Ohhhhh.

S: Good grief!

S: Run that one by again.

T: [Mrs. B. explains the point again and then continues.] If you're facing the map, up is north, down is south, and your right hand is . . . east. Right. And your left hand is . . . west. [Students return to their desks amidst a hubbub of pencil sharpening, chair scraping, and desk rummaging.] If you're done before P.E., you have fifteen minutes to find something quiet to do. Turn your worksheet in first. People, I think the maps on the top of your page will help you more than anything else. [She says this in reaction to the scurrying around the room for globes and atlases. Many students go to Mrs. B. for help. She offers it willingly and patiently, re-explaining often what she had explained in her general presentation.] If you're not done, stick it in your desk and finish it after lunch. Get ready for P.E.

T: From your list of three choices I made up a list of people who will work on the different topics. Sometimes there's only one person on a topic. You might not want to work alone. I tried to give you your number one choice, but there's no more than three in a group. If you want to switch, this is your chance now.

S: I'm on Mars. Can I change?

T: Yes, if you want to. If you're satisfied with the group you're on, pass the list on to the next person.

Students come to the rear table full of space books. A pair of girls get one book and go to the reading corner. Two boys come to find references on Cape Canaveral. Soon, the students are clustered in a tight knot at the table, searching for books that fit their topic. Two boys and a girl talk about who likes whom. The girl says she'll tell Tracy. Several boys wrestle over the use of the unabridged dictionary. Others play with halloween decorations and a little car. One group of three students, books in hand, wander a bit until they find what they feel is a comfortable place to settle down.

One group is investigating Cape Canaveral. Eric browses in an unabridged dictionary. Cindy looks at pictures in a reference book. She turns to one of a rainbow and says, "David, do you know if you walked toward a rainbow you could never touch it. It just looks like it touches the ground." David asks no one in particular, "You guys find anything yet?" I'll look in this World Book." Eric comes across the word "cobra" in the dictionary.

"Wow! Look at that. Six feet long." He tells Cindy not to copy down what she finds in her dictionary because it's the same as in his. As they determine that a book contains nothing of value to them, they return it to the main table, their initial large stock of carefully hoarded books slowly vanishing. Over a period of twenty-five minutes, the group's attention is fully focused on their sources, though not necessarily on Cape Canaveral. They speak frequently about not forgetting to take notes, but at most write only a few lines.

Mrs. B. ends this session as she announces, "People, in three minutes we go to lunch." Books are returned to the table and students line up in pairs, two girls waiting for Mrs. B's signal to leave with their shoe laces tied together.

The day after the above lesson Mrs. B. distributed the following outline of work in language arts which will accompany the class' social study work on space.

(Fourth Grade Unit Work on Spaceships and Explorers)

Space Monkey
_____go over new words with me, read story
_____worksheet
_____self-help 37, 38
_____workbook 50,51,52,53
_____conference with me

Three Skies
_____Read poem. What do you think the poet means?
_____Think about the colors you have seen in the sky--during the day, before a storm, at sunrise, sunset, at night. Draw a picture on a small sheet of paper which shows a sky . . .

America's First Astronauts
_____go over new words with me. Read part I, pp. 148-158
_____pretend you were writing about Alan Shepard's flight for a newspaper.
_____Tell about it in 3-5 sentences (or more). Include who, what, when, where, why, and how. Try to make it interesting but include necessary details . . .

Flight Song
_____read poem to yourself
_____get in a group of three people, to read it as a choral reading (one person reads the first stanza, another reads the second stanza, and another the third stanza. Then you all read the fourth stanza together.) Read it to me after you have practices . . .

End-of-unit
_____do p. 83 in book
_____on p. 184, pick one of the mini-stories and write several paragraphs about it
_____self-help p. 45-46
_____workbook p. 66, 67, 68
_____group contest
_____evaluate unit

Mrs. T.: (Second Grade Teacher

"I feel the same about social studies as I do about science. I don't see it as a subject for which there's a need for evaluation or a formal textbook. Second graders need the beginning of map skills. Kids today are conscious of places. We contrast rural and urban living, but don't do much with government. This year we participated in the mock election. We identified the candidates, not the issues. We used ballots from our Weekly Reader with pictures on them. The results here followed community and area results--pro-Ford, but not strongly. From time to time I encourage them to become aware of the news on TV and we talk about it. Each week we get our Weekly Reader and discuss the stories, look at the pictures. Each morning we have a discussion time, but they talk more about personal and family topics. I ask open-ended questions.

"As social situations occur in any of our reading material, they're used for discussion. For example, there's a story on Washington, D. C. and what some group of kids are seeing there. I get out my maps and we locate the Capitol, Washington Monument, etc. I'll bring in my own books on the White House and they'll do picture looking. I'll also bring books from the library so kids learn there's different sources of information.

"There's a few big things I try to get across under social studies. First, an introduction to map skills. Second, to get a feeling of their own family unit as part of the bigger community. Third, to talk about people in positions of authority in the school and family. And fourth, to understand types of work, ways of earning a living. Kids don't realize there are so many ways people earn a living."

APPENDIX A - STUDY GUIDE AND TEST FOR CHEMISTRY II

Chemistry II Chapter 17 Study Guide

23. What does the suffix -diene indicate?
24. What is the structural formula for butadiene? How is it prepared? What is it used for?
25. Write the 2 resonance structures for benzene.
26. What is the name and structure for the C_6H_5 group?
27. How is benzene obtained? What are some of its uses?
28. Complete the following equations. Write names for all products.

a)  + Br_2 $\xrightarrow{Fe}$

b)  + HNO_3 $\xrightarrow{H_2SO_4}$

c)  + H_2SO_4 $\xrightarrow{SO_3}$

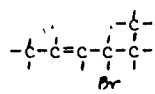
d)  + CH_3Cl $\xrightarrow{AlCl_3}$

e)  + C_2H_4 $\xrightarrow[HCl]{AlCl_3}$

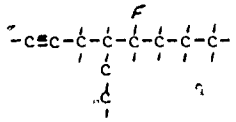
f)  $\overset{C_2H_5}{\xrightarrow[650^\circ]{\text{catalyst}}}$

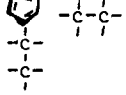
What is the product of f) used for?

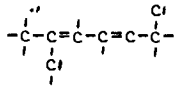
29. What is the name for  ?  ?
30. How is natural rubber produced?
31. Why is sulfur added to rubber?
32. What is vulcanization? Describe what happens during this process.
33. How is neoprene produced? What is its advantage?
34. How is SBR produced? Why is it used in tires?
35. How is buryl rubber produced? What is its advantage?
36. How is nitrile rubber produced? What is its advantage?
37. Draw structural formulas for each of the following compounds.
    a) 2-pentyne
    b) 1,1,2,2-tetrabromoethane
    c) nitrobenzene
    d) ethyl benzene
    e) 2,3,6-trifluoro-1-heptene
    f) 3,4 decadiene
38. Name each of the following compounds.

a) 

b) 

c) 

d) 

e) 

Chemistry II Test on Chapter 17

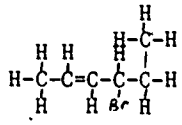
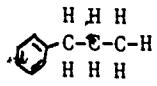
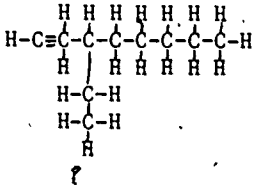
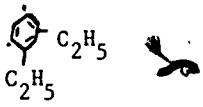
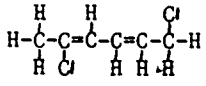
Part I: Answer each of the following questions completely and carefully.

1. Explain why a student should not perform any experiment with organic compounds without detailed laboratory instructions and then only with the supervision of an instructor. (5 pts)
2. Write the structural formulas for 5 of the isomers of C_5H_{12}. Name each of the isomers. (15 pts)
3. Write the empirical formulas for the compound consisting of 12 carbon atoms if (3 pts each)
   a. alkane
   b. alkene
   c. alkyne
4. Define each of the following. (4 pts each)
   a. dimerization:
   b. fractional distillation:
   c. cracking:
   d. vinyl group:-extra credit
   e. alkadiene:
   f. aromatic:
   g. halogen:
   h. vulcanization:

Part II: Draw structural formulas for each of the following compounds. (5 pts, each)

1. 2-pentyne
2. 1,1,2,2, tetrabromeoethane
3. nitrobenzene
4. ethyl benzene
5. 2,3,6, trifluoro-1-heptene
6. 3,4, decadiene

Part III: Name each of the following compounds. (5 pts each)

1. 
2. 
3. 
4. 
5. 
6. 

APPENDIX B - AN ASSIGNMENT FOR BIOLOGY CLASS

Questions for "Bugging the Bugs"

1. Define each of the following words.

   a. inoxuous
   b. efficacy
   c. entomologist
   d. pheromones
   e. ubiquitous

2. List at least 2 reasons why chemical insecticides' usefullness is now being questioned.

3. What is "integrated control" of insects?

4. List at least 3 techniques used in "integrated control".

5. When and why did the U.S. first use biological controls?

6. Describe the method being used to control California's bollworm.

7. In what other ways are sex pheromones being utilized?

8. How are juvenile hormones being used to control insects?

9. What does Altosid SR-10 do to mosquitoes?

10. What does Dimilin do to insects?

11. What are "anti-hormones"? How do they affect insects?

12. List 2 disadvantages of using hormones and anti-hormones.

APPENDIX C - STUDY GUIDE AND TEST FOR BIOLOGY

Biology Chapter 4 Review Sheet

1. Define cell.

2. Describe Hooke's experiment.

3. Did Robert Hooke really discover cells? Explain.

4. What experiment did Dujardin conduct?

5. What were the contributions to biology of Schleiden and Schwann?

6. State the two points of the cell theory.

7. What recent discoveries have aided biologists?

8. Give an example of each of the following cell processes in humans.

a. nutrition
b. digestion
c. absorption
d. synthesis
e. respiration
f. excretion
g. egestion
h. secretion
i. movement
j. response
k. reproduction

9. List the parts of a cell found in each of the following structures.

a. nucleus
b. cytoplasm
c. cell wall

10. Describe how each of the following structures would look under a light microscope and give the function of each structure.

a. nucleus
b. nuclear membrane
c. nucleoplasm
d. nucleoli
e. chromatin
f. cytoplasm
g. plasma membrane
h. vacuolar membrane
i. cytoplasmic matrix
j. endoplasmic reticulum
K. ribosomes
l. mitochondrion
m. lysosomes
n. Golgi apparatus
o. plastids
p. cell wall

11. Define organelle.

12. Define:

a. chlorophyll
b. chloroplast
c. xanthophyll
d. carotene
e. chromoplast
f. leucoplast

13. Describe the internal structure of a chloroplast.

14. Describe the internal structure of the cell wall.

15. Describe the structure of primary and secondary plant cell walls.

16. Describe how the ultracentrifuge has aided the study of cell organelles.

17. Describe how radioautography is used in the study of cells.

18. Define:
    a. unicellular organism
    b. colonial organism
    c. multicellular organism
    d. cell specialization
    e. tissue
    f. organ
    g. organ system

Biology Test on Chapter 4

PART I: In the blank provided at the right, write the word or group or words which BEST completes the statement or answers the question. (3 pts each)

1. The biologist who first viewed living cells and observed that they had content was __?__

2. The process by which insoluble, nondigested particles are eliminated by a cell is __?__

3. The structural unit of all life is the __?__

4. A series of double membranes which connects the plasma ~~membrane~~ and the nucleus is called the __?__

5. The "suicide sacs" of the cell which contain digestive enzymes are called the __?__

6. The material located in the nucleus of the cell which carries the cell's heredity is the __?__

7. The yellow pigment found in cells is __?__

8. The organelle believed to function in secretion and storage because it is often found in glands is the __?__

9. A group of cells which work together to perform a particular function is called a (an) __?__

10. The center for cellular respiration and energy release in the cell is the __?__

11. The biologist who first saw cells by looking at pieces of cork was __?__

12. The process of transporting food, water, and other essential materials from the environment into the cell ~~is called~~ __?__

13. A group of cells which live together, but have no real dependence on each other form a (an) __?__

14. The material which gives extra strength to the secondary plant walls of woody plants is __?__

15. Small, spherical bodies in the nucleus which function in cell reproduction are called __?__

16. The red-blue (purple) pigment found in beets is called __?__

17. The plastid in the cell which has the function of food storage is the __?__

18. Small, dense, spherical bodies which are found on the endoplasmic reticulum and function in protein synthesis are __?__

19. The outer edge of an animal cell is called the ___?___

20. The cells of the ovaries and testes are specialized for the process of ___?___

PART II: Answer each of the following questions.

1. State the 2 points of the cell theory. (6 pts)

2. List 2 recent biological techniques which have aided biologists in discovering new characteristics of cells. (4 pts) Describe how each has been used. (6 pts)

3. Make a sketch of an Anarcharis plant cell. Label: cell wall, chloroplast, cytoplasm (8 pts)

4. Make a sketch of a human cheek cell. Label: plasma membrane, nucleus (6 pts)

5. Make a sketch of an onion cell to which iodine has been added. Label: cell wall, nucleus, necleolus, oil droplet (10 pts)

WORDS FOR PART I OF TEST ON CHAPTER 4

cell	nucleus	chlorophyll
hooke	nuclear membrane	chloroplast
Dujardin	nucleoplasm	xanthophyll
Schleiden	nucleoli	carotene
Schwann	chromatin	chromoplast
nutrition	cytoplasm	leucoplast
digestion	plasma membrane	anthocyanin
absorption	vacuole	lignin
synthesis	vacuolar membrane	cellulose
respiration	endoplasmic reticulum	pectin
excretion	ribosome	unicellular organism
egestion	mitochondria	colonial organism
secretion	lysosome	multicellular organism
movement	Golgi apparatus	tissue
response	plastid	organ
reproduction	cell wall	organ system
	organelle	

APPENDIX D

Algebra One Quiz

Given that U = { 0, 1, 2, 3, 4, 5, . . . } and A = {all even whole numbers}

1. Give the roster for set A.
2. Form set B, where the elements of B are obtained by multiplying the elements of set A by 5/2.
3. Form set C, where the elements of C are those elements common to both A and B.
4. Referring to the foregoing sets A, B, and C, indicate which of the following statements are true and which are false:

   a. $C \subseteq A$ c. $A \subseteq C$ e. $B \subseteq A$ g. $A \subseteq B$ i. $A \subseteq A$

   b. $C \subseteq B$ d. $\emptyset \subseteq C$ f. $a = B$ h. $33 \in C$ j. $303 \in B$

5. List all the subsets that can be obtained from { R, E, D }.

With the universe of all the numbers you know, draw graphs for each of the following:

6. {0, 3, and all numbers between}
7. Graph set C from exercise three above.
8. {All numbers greater than 2}
9. {7, and all whole numbers less that 5}
10. {All numbers between 0 and 3}

APPENDIX E

Sociology Test - Chapters 1 and 2

Matching - In the space at the right of each definition, write the letter of the word it defined.

A. plurel	E. case study
B. group	F. pure science
C. society	G. applied science
D. hypothesis	H. community

1. Group of people living near each other in order to satisfy their daily needs.
2. A plurel in which people affect each other's behavior.
3. Research conducted for the expansion of knowledge, not for the sake of utility.
4. A social entity consisting of two or more people.
5. Largest group of people who share a unique way of life, occupy a definite territory, and think of themselves as a social unit.
6. Research conducted in order to make practical applications of scientific knowledge.
7. Group of people living near each other in order to satisfy their daily needs.
8. A piece of research which focuses on a specific group of people.

TRUE-FALSE - Place a T after each statement which is true and an F after each statement which is false.

9. In sociology, the comparative method involves the study of primitive societies and more advanced societies.
10. Sociology is the scientific study of the human individual.
11. Secondary groups are characterized by impersonal, non-emotional relationships.
12. The observation of data is the first step in the scientific investigation of a problem.
13. The essential quality distinguishing a human group from all other plurels is interaction.

MULTIPLE-CHOICE - Write the letter of the best answer in the space at right.

14. A family is an example of (a) a secondary group, (b) a primary group, (c) a society, (d) an association.
15. A football team would be an example of (a) a primary group, (b) an association, (c) an ephemeral group, (d) a secondary group.
16. Sociology is considered to be a social science because (a) Plato and Aristotle classified it as such, (b) it deals with human behavior, (c) its theories can be used by other social sciences, (d) it uses the laboratory technique.

17. The statement "poverty is a cause for crime," is sociologically (a) a fact, (b) a hypothesis, (c) a variable, (d) an exaggeration.

18. If a sociologist joined a submarine crew to study it, he would be (a) pretending he was someone else, (b) engaging in participant observation, (c) trying to get an outsider's view of the ship's morale, (d) locating inefficient members.

ESSAY QUESTIONS:

1. Why is a summer visitor or a tourist a poor observer and interpreter of a foreign country?

2. Can you explain why sociology is needed in modern times?

3. How does your community help you to meet your needs? List as many as you can.

ALAN PESHKIN

Alan Peshkin, Director of African Studies at the University of Illinois, has served as a Professor in the University of Illinois College of Education since 1967. He lives in Champaign with his wife, Maryann, and their three children.

Since receiving his Ph.D. from the University of Chicago in 1962, he has taught courses both in social studies teacher education and in comparative and international education. He is the recipient of a Guggenheim Fellowship (1973) for the study of the relationship between school and community in rural areas (forthcoming as Growing Up American: Schooling and the Survival of Community, University of Chicago Press). He is also the author of Kamin Schoolchildren, published by Holt, Rinehart and Winston in 1972.

To his participation in the CSSE project, he brings the insights of a specialist in comparative education.