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ABSTRACT
                Arguing that curriculum developers need to seek a
better understanding of existing classroom orders before advising
reform through new technology, this paper presents a review of
research on the effects of microcomputers on the stabilities of
classroom practice and describes a pilot study currently underway at
Queens University in Ontario to determine what science teachers think
about the impact of microcomputers on classroom management. The
research reviewed is discussed within a framework that takes the
teacher's perspective seriously and asks questions about how new
technology will be used in the schools. Issues addressed by this
research include the elements of student collaborative learning; the
roles of the teacher, print materials, and teacher guides; classroom
disruption due to the way computer-assisted instruction (CAI)
materials are organized; and changes in student-teacher
relationships. Data collection procedures for the two strands of the
pilot project are also described, i.e., a projective test and
audiotaped interviews to explore teachers' thinking on microcomputer
use in the classroom, and videotaped class activities to show how
microcomputers are actually being used. Detailed descriptions of
interviews with a sixth grade science teacher and an eighth grade
science teacher are provided, and a discussion of some of the
concerns voiced by these two teachers concludes the paper. (DJR)

Microcomputers in the Classroom:

Trojan Horse or Teacher's Pet?

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2

MICROCOMPUTERS AND THE CURRICULUM

Those who would wish to alter the routines of the classroom; those who want to get teachers to do things another way would be well advised to find out what it might mean to teachers to do things differently. Microcomputers, for some of those who advocate them are for them ikons celebrating new ways of educating children; for others the microcomputer is more like a trojan horse inside of which are forces which might disrupt the routines of the classroom. The advocates see a new order; one to which they hope to rally teachers, but teachers are concerned about the old order and its functions. How will these two universes interact?

Behind this paper is a plea for curricularists to seek a greater understanding of the existing order of things in the classroom so that we who advise reform through new approaches might understand the significance of what we propose. It is only good tactics that I argue for here; I'll save questions of grand strategy for another day.

Talk of computer literacy and the attention paid to such arguments for helping children become familiar with the technology shows just how central this new technology is. It should be noted that the appeal to literacy as a way of arguing for science in the curriculum never did receive the same attention and respect as is now given to appeals for computer literacy in official documents and the popular press.

Although computer literacy is an important goal, the really central issues emerge when we look at the computer as a basis for computer assisted learning. Decker Walker in his Kappan (1983) article on computers notes seven attributes of computer-based learning that are plusses; the list is impressive. Three interest me here: individually tailored learning; independent learning; and more active learning. These potentials for the technology raise interesting questions about the ways the technology will interact with how teachers prefer to run their classrooms. It may turn out although I hope not that what computers might best be able to do is not the kind of thing teachers have ever been comfortable with. This is certainly a suspicion to be harboured and to be concerned about.

Nonetheless there is no doubt that computers are special in the history of new technologies. They are not teaching machines; not the same as VCRs nor chalk boards; but how are they special? What are people claiming for them?

Here I think recent research on the classroom impacts of computers is illuminating. We can begin to see some interesting research questions emerging from this literature. Behind the visionary claims being made for the technology, questions about the effect of microcomputers on the stabilities of classroom practice are emerging. I would like to point to these through a review of recent research. Having done that I want to return to a discussion of

research now underway at Queen's which is beginning to pursue some of these questions. I will discuss that research within a framework that takes the teacher's perspective seriously; that asks questions about how this technology will be used in schools.

MICROCOMPUTERS AND THE CLASSROOM ORDER

Research reports I have looked at recently suggest that the social dimension of computer use is important. Jan Hawkins (1983) at Bank St. College hoped that doing LOGO would promote collaboration amongst children. However, instead of collaborating, the children consulted each other but did their own work. The children did not seem to value collaboration and did not share the researchers enthusiasm for collaborative learning. In reading this I wondered what the teacher thought of collaborative learning. There is always a danger that the researcher, having a commitment to particular forms of classroom organization, looks for those forms in the new technology or approach and is disappointed not to find them. (see for example, Berlak and Berlak, 1975).

While using microcomputers might have the potential for promoting collaboration that Jan Hawkins was looking for, that potential would have to be realized through the teacher. The teacher is the one who is ordering the life in the classroom, not the microcomputer.

Hawkins' work raises the further question of the role

of print materials and teacher guides. Perhaps the
possiblity for collaboration was not built into the
supporting printed materials, or if it was, it did not
affect the way the teacher and the students used the
material. Parenthetically, there seems to be much stress on
quality programming in the literature but less attention
given to the nature of support material. Often children
must interact with only one microcomputer in the classroom
and have to rely on print materials to help integrate the
computer work with other activities.

Hawkins raises a central question about the
indeterminate status of the computer in the classroom.
Children consult together now because the work they do on
the computer often isn't mainstream--not serious. What will
happen when the work is serious and grades depend on it and
children compete for grades? Will such fundamental issues
for classroom life act as barriers to realizing the
potentials of computers?

Marjorie Rogosa's (1979) study of CAL used for remedial
purposes documents one of the fears that teachers have about
CAL; the fear they cannot keep up the flow of work of the
class. She found that teachers were worried about the flow
of their classrooms being disrupted by the way the CAL
materials were organized. Ironically the individual rates
of progress that so concerned Rogasa's teacher are said to
be one of the virtues of the technology; but apparently not
entirely a virtue for teachers. (See also Richard Carlson,

1965).

Brine (1982) suggests that the computer can be used to shift the social climate of the classroom away from competition to collaboration, and he is concerned that the computer will in fact promote competition through the rush in the classroom for scarce resources. A change in student-teacher relationships is the implied norm in the Hawkins and Brine papers. It is not clear, however, how teachers might view this norm. Do teachers want to promote collaborative relationships within their classroom? Is this what it means for them to have a computer in your classroom? What do teachers think about this idea? Although thinking about the potentials of the computer is important, I think it is also important for these norms to be looked at from the perspective of the teacher. How might research be conducted within the framework of such a concern? This question brings me to a discussion of our research into how teachers think about the impact of microcomputers on the classroom order.

RESEARCHING THE TEACHER'S PERSPECTIVE

We are interested to find out what it means to teachers to work with microcomputers in their classrooms. Rather than focus on the visions of a new intellectual medium, we want to find out what teachers make of the technology in the way they use it. What challenges to the practical theories of teachers are posed by microcomputers? And particularly

what challenge to how teachers construe their <u>influence</u> in the classroom; a concept I will return to briefly later.

I think research like this has the potential to inform those who plan teacher inservice courses and those who write the critical support documents that ought to go with the program disks and this is where I see research and development joining together. Through joint effort people who engage in teacher education can begin to probe teacher thinking about microcomputers and people who design lessonware can investigate some of the factors that should be considered in developing effective lessonware and guides in support of what is seen on the computer.

Decker Walker warns us about what might happen if we are not careful in the way microcomputer potentials are promoted. He notes that they are hard to use and that there is much upset to routines associated with them. The rhetoric surrounding computers stresses breakthrough and innovation at a fast pace (See also Nicholls, 1983). Where is the teacher to place him/herself in all of this? What would a settled form of the technology look like from a teacher's perspective? Shouldn't we know something about how teachers see the technology in the classroom as part of the process of putting together school oriented machinery and software? Given these concerns it becomes important to know how teachers think about using microcomputers in their classrooms. How to research such a problem and with what sort of theoretical perspective in view?

We have now completed the field work and data reduction of a pilot study of two teachers who worked with us in the development of lessonware. As an adjunct to their work in field testing the materials we developed, we asked them to participate in a small scale research project using clinical interview techniques developed within a qualitatively oriented research framework (Olson, 1984). The data have not yet been fully analysed so the comments here as far as results go are preliminary.

In what follows I will outline the general approach and say something about the specific strategies we used in the pilot study and end by taking a look at some of the data we have collected, how it was analysed and what seems to be emerging from it; all of this by way of illustrating one way in which we can gain some understanding of teacher perspectives.

There have been a number of studies into teacher thinking about innovation in areas like reading (Dufy, 1976), open education (Bussis et al, 1976) and integrated science (Olson, 1980). Much of the focus of existing research on microcomputers has been on their potential to promote intellectual growth (Pappert, 1980), or on how students and microcomputers interact (Pea, 1983; Brine, et al, 1983). We know very little about the patterns of use of microcomputers in elementary classrooms and the reasons for these patterns, and less about what teachers think about these patterns and the teacher's role in the creation,

maintenance, and change of those patterns.

There is reason to think that there may be difficulties ahead for teachers attempting to alter their classroom patterns to accomodate microcomputers. Research we have conducted with science teachers, for example, suggests that if teachers do use computers in the way many proponents suggest, they may face what might be called an erosion of their influence (Olson, 1981); for example, it is not all that clear that teachers favour student independence. There is a large body of research that suggests that teachers tend to maintain control over the point and direction of the lesson (Calderhead, 1983; Larson, 1984) and that this control is maintained at the expense of the potential of the innovation. Carlson's (1965) classical work on teaching machines showed that teachers arranged class activities so that uniform progress of the class was maintained in spite of the potential of the machine to allow for individual rates of progress, and added to this is the fact that student capabilities with microcomputers pose an interesting challenge for teachers. This particular issue is one we are trying to pursue.

Our work on teacher influence indicates that teachers run into difficulties when they believe that their influence over the point and direction of their lessons is diminished. Inquiry oriented science materials, for example, pose difficulties for teachers which they believe have to do with loss of influence, and the results of a recent major study

10

of science education in Canada suggest that this is a common phenomenon across divisions of the curriculum (Olson and Russell, 1983). Microcomputer technology might also represent a perceived threat to teacher classroom influence and we might find that intellectual potentials of technology are diminished as teachers modify their use of it in accordance with their overarching concern to preserve influence.

With these comments in mind I turn now to details of the research we are now conducting. This starts from four questions:

1. What kinds of goals do teachers seek in their use of microcomputers; what balance exists between sociali- zation and education goals and are there conflicts be- tween such goals?

2. How do teachers construe their influence over class- room events involving microcomputers?

3. What contextual factors affect the way teachers con- strue their influence in the classroom when using micro- computers: knowledge of microcomputers; abilities of children; access to courseware and other support; class behavior?

4. Do teachers differ across school divisions in the way they construe their work with microcomputers, and in the factors that affect how they view their work?

The research methodology is based on the idea that what people say they do and what they do are not always the same.

Means must exist to check one against the other. In order
to probe teacher thinking about microcomputer use a version
of the Kelly (1955) repgrid is being used. In interviews
teachers complete a projective type test which makes use of
their own constructs. In order to elicit constructs 30
microcomputer "situations" are presented to teachers (See
Table 1). They are asked to group these situations
according to some underlying commonality, and to describe
the commonality and to contrast it with its polar opposite.
The 30 "situations" have been drawn from a content analysis
of approaches to the use of microcomputers found in the
pedagogical literature associated with the technology and
from comments about practice obtained from the teachers in
preliminary interviews. Once constructs are elicited,
teachers are asked to evaluate each situation in relation to
each construct.   Five constructs are supplied
and five or so elicited. In this way a grid is obtained
which is being analysed in a number of ways, including
factor analysis. Each grid is analysed as a basis for
developing a follow-up interview protocol.   In
this interview teachers are asked to comment on their grid
and it is here that teacher thinking is probed in depth.
The interview is tape recorded.

These data are being analysed in relation to the
research problems. Teacher thinking about microcomputer use
will be drawn from a content analysis of their comments on
the grids, and from the grid data themselves, amongst other

1. A student has "crashed" the program and has asked the teacher for help.

2. Some students are talking with a pair of students working on the computer and distracting them.

3. A computer experienced student arrives from another class to help the teacher with a problem.

4. The teacher asks the student to do a tutorial on the computer. The student asks to have a game.

5. The teacher is removing a stuck diskette from the disk drive while impatient students wait.

6. The tutorial program a student is working on gives an answer the student does not agree with. The student calls the teacher over.

7. The computer asks a student to hypothesize. The student is stuck and asks the teacher for help.

8. Students are programming music on the computer. Other students at their seats stop their work to listen.

17. The class is going to the library to do math tutorials on a bank of machines there.

18. A student doing word processing says she's shy about people seeing her work and asks for the machine to be moved.

19. A student wants to list the program of a piece of software and modify the program.

20. The computer has to leave the classroom before students are finished with the program they had been working on.

21. A few students asks for more of their math work to be based on the computer.

22. A group of students have not completed their work on the computer in the allocated time. They want more time.

23. A long line of students has formed at the computer waiting their turn.

24. Students did not read the instructions in their workbook and are asking for help at the computer.

25. Some students are 2 or 3 lessons ahead of the rest of the class. They are asking for more work.

9. The teacher is using a computer at her desk to make up a multiple choice test.

10. As planned two students have left the room to do Logo on the computer in the hallway.

11. Some students are asking to spend their recess at the computer.

12. A student asks the teacher to do a BASIC operation on the computer. The teacher doesn't know how.

13. Some students seem to copy work from their partners.

14. One student does not want to work with another student at the computer.

15. A student tells the teacher she was bored with the tutorial she is doing.

16. The teacher has stopped the class so that a pair of students can explain a programming routine they have just completed.

26. Some students are doing math problems on the computer that are part of the next grade.

27. A boy tells another student to hurry up and finish at the computer. The student objects.

28. The teacher is having difficulty leading a brain storming discussion aimed at discovering the nature of a simulation the class has been studying.

29. A teacher is asking a pair of students to hurry up their work on the computer. They say they do not understand the instructions.

30. Students who finish their work early are playing a game on the computer.

Table 1 Events used as elements in construct elicitation

sources of data. In further research beyond the pilot phase
we are now in, teachers will also be asked in informal
interviews to comment on contextual factors. These comments
will be related to their grid material.

As a check on what teachers say they do, teachers will
be asked to review a videotape of a classroom activity
involving their use of microcomputers and to give a running
commentary on what they and their students are doing. This
stimulated recall method is commonly used as a way of asking
teachers to explain their classroom activity, and as a basis
for probing their thinking about practice. It also acts as
a check on the interpretation of other data collected.

What have we found from these preliminary efforts to
understand how teachers see the use of microcomputers in
their classroom?

In developing our research procedures we talked to two
teachers who had cooperated with us in the development of
lessonware. We had already been in their classrooms and
observed their students working with the science simulation
we had developed. Mrs M. taught a grade six class and she
had been using the simulation for three weeks, which she
said constituted the bulk of her experience with micro-
computers. Mr. R. had also used the simulation for about
the same length of time, but was also involved in another
computer project; two Apple computers had been in his room
for some time. At the point where he began to work with us
his grade eight class were used to going to the back of the

room to work at the machines.

In order to understand what these teachers thought about their experiences with microcomputers we asked them to participate in two interviews; one in which constructs were elicited using the method described above and one in which we discussed the way they had completed their grids. We began with Mrs. M.

CONVERSATIONS WITH MRS. M.

We asked Mrs. M to sort the 30 teaching events (Table 1) into groups using categories she felt were important. Once she had done this we asked her to describe the categories and in this way five constructs were elicited. These were:

- stressful/unstressful;
- being "with it" risk high/low;
- high monitoring required/low;
- students taking advantage risk high/low;
- waste of time risk low/high.

These constructs were placed on a checklist sheet along with supplied constructs, and Mrs. M was asked to construe each teaching event using each construct. In this way a 30 x 10 matrix of data was obtained. Subsequently correlation amongst the constructs were obtained and that matrix was factored.

We are interested in the interrelationships amongst constructs because we think they represent different but related ways in which Mrs. M construes her <u>influence</u> in the classroom. The notion of influence goes beyond classroom

control to include the way Mrs. M <u>expresses</u> her teaching as a person as well as how she acts <u>instrumentally</u> to help her students learn. Clearly both aspects of her work are important, but the expressive component is currently of most interest to us.

Our follow up interview with Mrs. M was intended to help us understand better what she meant by her constructs. In order to probe further these meanings a follow up interview took place using questions based on the way she had completed her checksheet. The interview lasted for an hour and was tape recorded and transcribed.

To explore what Mrs. M meant by her constructs we chose to discuss with her situations in which there seemed to be a well defined application of constructs to a situation. This situation was then discussed using Mrs. M's terms in an attempt to see how she construed the situation; in this manner we discussed ten situations. Space doesn't permit an extensive treatment of them all and we haven't yet really worked through to a relatively comprehensive picture of Mrs. M's perspective; thus the following discussion is quite preliminary and tentative; but illuminating we feel.

<u>Situation Four</u>: [The student who would rather play games than do a tutorial.] We asked Mrs. M.: "In what sense are the students taking advantage? Where is the waste of time risk?"

Q   The teacher asks the students to do a tutorial on the computer and the students ask to do a game. And you've suggested that students are taking advantage of

the teacher. I just wondered what the type of advantage was.

A   It's the one where they try to either see if they can wear you down, so if they nag you long enough, or they bug you long enough, they can end up doing what they want.

Q   Getting their way?

A   Thinking that you don't either have the time to spend on explaining it all to them and why. Or that, you know (how children are) with parents. If you bug them about it long enough they get so sick of you that they'll let you do what they want. So that's a typical kind of situation.

Q   So you sense the kids...?

A   He wants to do something that he thinks may be more fun, rather than the tutorial which may be a little more work for him.

Q   It would seem as a waste of time?

A   Yes. The amount of time that you can spend ... Well if you let yourself fall into that trap - of negotiating. And then, secondly, if he ends up having to do something that he really doesn't want to do, is he going to be serious about it, or is he just going to play around ...?

Q   So already that kid has to be watched ...?

A   Yes. He's trying to signal he is resistent to this learning activity and I think you've got to do something about that. Is he going to get anything meaningful out of what you want him to do?

Q   Teacher high monitoring indication there, which is consistent with what you've said. So he needs to be watched?

A   Right. And why it wasn't stressful is because that's such a typical situation - we do that all the time.

Q   Nothing new as far as computers go?

A   Yes.

Q   So in a sense you're saying kids often want to do something that they would rather do, that you don't want them to do, and there is nothing special there

for computers - there's no extra edge here in the sense that ...?

A   Right, it's probably even less stressful because almost anything they do on computers they enjoy, and so it's not even as hard as, well, instead of writing extra spelling words three times each, you know. They'd rather do a spelling bee or something. As long as it's on the computer, they are going to enjoy it more than other choices. So, even if you give way, they are going to get something out of it.

Q   So, even if you let them do it on the computer, their attitude is better?

A   Yes, their attitude is better towards any task involving the computer than if they have to do something that's the regular.

Q   So even though they do a tutorial on the computer, the edge is off of it. If you're going to do spelling words - that's really boring.

A   Yes, so he'd say, well O.K. if you don't want to do it on the computer, how about you just go back and do your seat work instead. Well then, they will decide to stay on the computer.
    [Laughter]

The fact that the student wants to play a game isn't anything new. In a sense children are always nagging teachers about doing something else. The interesting point about the computer for Mrs. M. is that even having to do the tutorial is still better than being back at one's seat doing something there. This kind of "negotiation" however may end up as a waste of time; partly, perhaps, because the child who has signalled his disinterest has to be watched - is she/he getting on with it? The student may be working at the computer but how does the teacher know that he/she is getting anything out of it; especially those students who the teacher knows need to be monitored. Usually the teacher can monitor these students quickly at a distance. As Mrs.

M. suggests monitoring isn't that easy where computers are concerned because it isn't that clear <u>where</u> the student is at. We see here at once the two faces of the computer: pet and trojan horse. There is nothing new in using the computer as a "carrot" like other desirable activities. This is an entirely domestic thing, but will the students get on with it? It is not so easy to tell when they are working at the computer. This is a nagging worry; the level of teacher monitoring may have to increase.

<u>Situation Six</u>. [The student doesn't agree with the answer in a tutorial problem and calls the teacher over]. We asked Mrs. M. "Where is the 'with it risk' in the answer disagreement?"

Q   I'm just wondering what's at stake there for you as a teacher when a kid does something like that?

A   I'm thinking of somebody who doesn't have much background, either working with a computer, or, you know, knowledge of the computer programming; so that if there's a flaw in there, the teacher may not be able to diagnose where it went wrong. So there you are exposing your ignorance of working with computers, and you're no longer the source of knowledge for the child that they expected you to be; (to have) that sort of credibility. Whereas Whereas in most other subjects in the classroom, if they run into a difficulty with something in the textbook, you can always put the pages back. You're likely to be so familiar with all of that work that you've got the right answer ready, and you can spot immediately, say if they are working on a fraction problem, you can spot right away: "Well you didn't multiply by ..."

Q   You can't back it up? Is it that??

A   Well, if you're not conversant with how a computer operates you may not even know where breakdowns can occur, and then you would be totally lost.

Q   Right. Well this may not be a breakdown. It could
     be just a situation where the kid didn't get the
     right answer. Look it up in the back of the math
     book - answer doesn't agree, sort of thing. That
     can happen.

A   Yes. But then you could probably work it out
     yourself pretty quickly and see what the problem
     is.

Q   Right.

A   But with computer work you may not always have the
     background knowledge to be able to do it.

Q   Unless you know the tutorial problem very well.

A   Right.

Q   In which case you might.

A   Yes.

Q   Or am I putting words in your mouth?

A   No. That's what I meant. Just a very simple thing
     - like you misread a direction, or you punched in
     the wrong number of candles, or something.

Q   Yes and that's ...

A   And then you get just a little bit uptight,
     because if you don't solve this problem this whole
     thing is going to be lost and secondly, you just
     feel a little more threatened because you're so
     used to being able to solve problems, that now
     when you can't, you ....

Q   Yes - I have the same feeling with my daughter's
     Grade 9 math problems sometimes. Is it like that??
     When you can't dodge back and ...

A   Yes. Because I think we're all at the stage where
     we have competence in areas that we're quite used
     to and that we can handle quite well and being able
     to pass along.

Q   Yes. So this may be a special edge on the computer
     that's newish.

A   Yes.

Q   O.K. I understand that now. There's a high
     monitoring in that.

A   Well, that's because you have to work through a
     whole series of steps with them all over again, and
     just see the breakdown happen. You have to go back
     over the problem.

Q   Right - so monitoring to some extent means
     literally one-to-one teaching?

A   Yes, that's what I think it is.

Q   One-to-one teaching?

A   Yes, you are right there watching them do it, and
     you have to be totally involved with it. And you
     can't be distracted because you could miss
     something important.

Q   Then monitoring is shifting off total class, to
     focus on an individual kid - somehow, either
     face-to-face or keeping an eye on that kid. Would
     that be part of monitoring?

A   Well, mostly I was just taking it as that you had
     to be there and watching what they were doing.

Q   Even if you were just watching over their shoulder,
     but you had to be involved in what they were doing
     to be able to either see whether he was making
     mistakes, or whether he was following the right
     sequence of steps, and ...

A   Yes. When I'm not as sure of what I'm doing then
     I feel a greater need to be closer by.

Q   I'm just trying to see whether monitoring has any
     distance factor in it for you.

A   Well, when you can't really spot at a distance when
     they are at a computer, because they could be
     putting in silly names.

     Mrs. M. focuses on the technical problem that might be

causing the difficulty rather than the idea that the student

has simply come up with an answer that diverges from the

"book". In the case it isn't a book but a computer and Mrs.

M. feels at risk because she cannot go back into the "book"

and if the right thing isn't entered into the computer

things may not work. A book doesn't fall apart when you

write down the wrong answer. In a sense the right answer turns the pages of the computer. You can't always turn the pages if you don't get the answer right and you can't look back. It is all buried in the program. In a sense the computer is a black box and you can't look inside. Monitoring means working closely with students -- finding out where they are at. Are they stuck? How can they be unstuck? The computer seems to represent a new kind of "stuckness" and requires a level of monitoring seemingly more intense and demanding than Mrs. M. normally has to engage in. To be helpful she has to be quite close up to what the student is doing and even then there is no guarantee that she'll be able to spot the problem. At risk here isn't only her capacity to help, but her sense of being a "with it" teacher; someone students can rely on.

Situation 7 [Here the student has been asked to hypothesize and is stuck]. We asked Mrs. M: "Why is 'hypothesize' stressful, a 'with it' risk and also needing high monitoring?"

Q   The student is stuck and asks the teacher for help.
    Now this one came out as needing high monitoring.
    What's happening here with hypothesizing?

A   Well, it's a very high level activity, where not
    all students are really at that stage where they
    can do that. And so, you have to pose the right
    series of questions to have things work up to that
    level. And so there is a very one-to-one inter-
    action.

Q   Quick thinking on the part of the teacher?

A   That too.

Q   Is there a temptation to do it for them?

A   Sure - because, if it's a slow person and they are
    taking a lot of time, and, especially if it's
    obvious to you, you get a little impatient there,
    and if it's the fourth person that afternoon that has
    run into the same problem, you're kind of tired of
    going through that sort of sequence.

Q   So you kind of ...?

A   Well you try not to but...

Q   The temptation...?

A   By the fifth person you're tempted!
    [Laughter]

To the extent that the computer asks students to engage
in high level thinking there is a monitoring demand if
students cannot do this alone. How well will this square
with the expectation that computer programs are "stand
alone" and not only alone without the usual print matter that
teachers rely on, but apart from the teacher? Again the need
for close contact with what the student is doing seems to be
seen as a special demand on the teacher.

Situation 16.   [The teacher has stopped the class so
that a pair of students can explain a programming routine
they have just completed]. Situation 21. [A few students
ask for more of their math work to be based on the
computer]. Why is a student report on programming a "with
it" risk, we asked Mrs. M.. We also asked: "Elements 16 and
21 seem to be similar situations; are they?"

Q   The student report is a with it risk. Why is that?

A   Well for me it wouldn't bother me, because I like
    to give them lots of opportunities where they can
    sort of shine at something, and have the chance to
    show leadership.

Q   It generally fits into your work?

A   Oh yes.   If you can't do it yourself, get somebody
    who can.

Q   Right.   It's just occasionally I suspect there are
    some feelings that..?

A   Well, you think that you should find more about
    this, and then it's frustrating because you don't
    have the time or the inclination - or the aptitude,
    not the inclination, but you don't have the
    aptitude.

Q   Right - It's the mental set.

A   Right.   Kids tend to pick it up and you think,
    maybe if I made more of an effort on that I really
    would.   But this doesn't bother me that much, but I
    know of other people who really get uptight about
    that kind of thing.

Q   And it's not a thing to do with young teachers/old
    teachers either?

A   No, because it is a difference in aptitude and
    interests.   I'd be willing to venture that the
    people who have done the least to develop
    themselves and who have the narrowest frames of
    interest in their own lives are the ones who are
    most threatened by anyone else showing any kind of
    expertise in a subject that they don't have, and
    yet they don't make any effort to further themselves
    in it too.

Q   The computers may have an edge to this.   Where you
    can't budge it so easily.

A   Well computers will make it even worse.

Q   Questions 16 and 21, the business of the report, and
    21, students asking for more of the work to be
    based on the computer, seem to be similar problems.
    Are they?

A   Yes.

Q   In those two cases where the kids are showing off
    there, and these kids who are saying give us more
    math work on the computer.   What might be similar?

A   Well, the teacher may not be able to do that
    because she doesn't have the skills and the

programming, or access to the material there.

Q   You're on the spot?

A   You're on the spot, right. You're somewhat at risk
     because you're so used to being able to hand out
     all kinds of dittos and you've got math questions
     all ready.

Q   Yes?

A   Yes, right here - some problems to solve, but now
     you're asking for something in another area, and
     you're not prepared.

Q   Your racket has no string.

Although Mrs. M. indicated that there was a "with it"
risk attached to students giving a report she prefers to
think that such a report is simply another example of
students showing and telling; something domestic. Yet the
computer clearly represents a technical challange to her and
other teachers. The demand for more math on the computer
raises questions of skills in developing material. Again
the two faces. Supplying computer experiences isn't the
same as giving out dittos, as she puts it aptly. The
students who are the computer whizzes are putting pressure
on the teacher to liven things up. The computer caters to
the students' desire to have fun; but there is a twist in
the tail as Mrs. M. sees it. There are the "steps" to go
through in computer assisted learning and they require
patience. It isn't all fun, and some are going to be
frustrated and so there may be a backlash. The computer
oriented students may find that the fun they had hoped for
isn't there. The computer makes demands on them to get the
steps right -- just as it demands that Mrs. M. get them

ᵣᵢᵤᵢᵗ.

CONVERSATIONS WITH MR. R.

Mr. R. participated in the same procedures as Mrs. M. His constructs were these:

- management decisions - formal teaching
- computer related interaction - non-computer
- exploiting computer - underuse
- student controlled learning - teacher directed
- faster learners - slower learners
- underequipped - adequately equipped
- computer related student demands - non-computer

Of particular interest was Mr. R's notion of management and teaching in relation to computer experience. His views on this construct were explored in relation to a number of elements.

Situations Six and Seven [Tutorial program ᵧᵢ ᵣs an answer that the student doesn't agree with; the computer asks the student to hypothesize]. We asked him to explain why he saw these as similar.

Q So there seems to be a great deal of similarity here [between 6 and 7]?

A It's one of these situations when he's not quite sure of what's going on, and he's asking the teacher to help him. One is not sure how to make a hypothesis. "Well, [the student says] O.K. I'm stuck, I'm not sure what they're asking about." And the other one "I don't agree with the answer." The first question he's going to ask is "Well, Mr.R. . ., what's up here?"

Q Now I was rather interested also that you saw this as a management problem rather than a teaching problem. How do you see yourself in that kind of situation? Why is it a management problem rather than a teaching problem?

A Well it's the kind of thing where I'm going to go over and maybe I'm not teaching. I may suggest, in

the case of the hypothesis, "What are they asking
you to talk about? Oh, O.K. Now we know what it is.
Fine." I'm going to have to see if it is a
management thing; is this person tackling something
too difficult? Am I going to say, "Well, let's
check this out"? Or am I going to ask him to try it
again? I may ask him to go through the problem
again, as opposed to really teaching. Do I have to
teach this student? He's working on a tutorial
program. Do I have to teach him something that's
missing there? Does he not have the skill to handle
that? To me it's more of a management thing. How am
I going to get him to work out the problem?

Q A facilitator?

A When they say teach something, that is something you
don't know, and I am going to instruct you in it.
Whereas if I were teaching I'd be teaching the
youngster how to hypothesize. When he says he's stuck,
is he stuck on what does it mean to make a hypothesis"?
- or is he stuck on "what they want me to hypothesize
about"? He's obviously been working on something,
and I must have instructed him in some skill somewhere.
He's working with either a science lab, or a tutorial
or something in mathematics or something. And as
opposed to going over and teaching him something right
on the spot, I'm going over and trying to help him
get out of his dilemma.

For Mr. R. teaching is supplying something that is
missing, while management is making sure the student can
carry on and can actually do the work. The computer then
carries on the management function allowing the student to
maintain the momentum provided by the impetus of the initial
teaching which was given by Mr. R. His task as far as the
computer goes is to unblock the flow and fix whatever
technical problem exists. We are seeing here the idea of
getting the student "unstuck" much like what Mrs. M. talked
about.

Situation 10: [Students work on Logo in hallway] In
some schools the computer is located in the hallway so that
students can work on their own while the class does other

work. Mr. R. found such an arrangement violated his idea of proper procedures. Why?

Q   It calls into question existing management procedure, you see it as a management problem as opposed to a teaching one. Can you explain this a little bit more?

A   Yes. You might send somebody out into the hall to do their normal spelling, or something. But sending someone out to use the computer - that's something new. It's novel. You're putting them out on their own to use a complicated piece of machinery. Logo is new, by the way. It just seems to me it's a whole new era to send a youngster out to use a computer. People used to use the hall as sort of a place to do a little extra work and maybe a bit of painting. Here you've got the machine out there and you're sending them off on their own. Well, when you're saying Logo planning, it's not a formalized structure. They're doing their own thing out there, and they may be stuck and they're going to come back to me and ask for me to give them a hand. I'm going to be asked to leave, and I'm going to have to decide how I'm going to have to work that. Myself, I wouldn't put the machine in the hall.
[Laughter]

The complicated machine is no longer under the direct supervision of the teacher. It is the machine itself that is the focus on interest. Will the students be able to keep going without getting stuck; that is run into mechanical problems rather than say problems to do with Logo itself. Yet it may be the case that the mechanical and instructional problems are joined together in some way in Mr. R.'s view. Doing Logo, yes; but doing it using a machine; either the machine can go wrong, as in a communication problem (can't see the board) or the ideas may be beyond the student (can't understand what is on the board).

Situation 14: [A student is complaining that he/she

doesn't want to work with another student at the computer].

Why is this a teaching problem?

Q   This is rated as a formal teaching role, rather than
    a management role?

A   Yes, to me its a situation like, [the student says]
    "I don't want to work with Harry whether I'm working
    on a textbook, or a group project." It's not
    necessarily linked to the computer. So I have to
    decide why doesn't George want to work with Harry,
    and again that's management. I have to decide
    whether to say, "Sorry George you're stuck with him,
    or is there a particular reason." Then I could say
    "O.K. You'll work with somebody else, that's all."

Q   So why is this related to a teaching role, rather
    than a management role?

A   Well, because sometime I'm going to have to talk to
    people and say, "Maybe just because you don't want
    to work with somebody ..." I'm going to be teaching
    a little skill in society; in working with people
    here. I guess social graces, if you want to call it
    that.

Again Mr. R. makes a distinction between carrying on
with things by providing a way of unsticking a situation and
using the situation to teach. In the case of non-cooperation
he sees the possibility that an easy management solution
isn't available and that a "lesson" on social graces might
be needed. Nothing new here as far as the computer goes but
another instance where a decision has to be made about how
to keep things going.

Mr. R. sees only domestic issues at work here. The fact
that with few machines considerable student collaboration may
be needed doesn't seem at issue. The trojans haven't arrived.

Situation 3: [A student visits the class to share
computer expertise] Where the computer does raise new

managment issues is with the technical expertise that

its use really does demand. Take the case of the student

who visits the class to help the teacher. What sort of

a management problem is this?

Q How do you feel when a student comes in and offers
   this kind of help? And how do you see your role
   while he's in the classroom?

A Where the problem comes is that he's going to be
   doing things on the machine that I may not know how
   to do. I have to kind of leave him on his own as
   far as the technical stuff is concerned, but I have
   to watch it myself, manage it, and handle the
   situation. I think also, I'm going to have to learn
   some of that. That's the other side of the coin. I
   may be learning from the youngsters. Which is fine
   by me. It doesn't bother me at all. I don't feel
   threatend by it. But it's just new. It's something
   new, the computer is new, and what you can do with
   it is new. And the fact of having students who know
   far more about it because they have their own
   machine, is a new element. It's not under existing
   procedures, because you're dealing with something
   that's new. I've had students come in and help with
   mathematics, but it would be rare to find a student
   who knew a great deal more than grade 8 mathematics
   in grade 8. But there are a lot of kids that would
   know more than what we would be attempting to do
   with that computer. Because I have about 6 kids in
   there who have their own machine. In some cases as
   good as the machine as I've got here.

Q Well, lets look at some of the other things that
   came up. In what ways is the [student coming to
   your room] exploiting the computer's capabilities?

A If you have someone there who can utilize it, and do
   more with it, an experienced person who knows
   something about it, then I'm utilizing what that
   machine can do. If I say no to him, you can't do
   that. Then I am not using that machine to its
   fullest capability. And if that information can
   come from a student, great!! More power to it.

Q But is this actually a characteristic or feature of
   the machine, or is this a situation which lends
   itself to the computer?

A   Well, I think probably a little bit of both. I
    mean, you can't use something if you don't know how
    to do it. And that's why I rated that yes. I'm
    going to use the computer to the maximum
    capabilities I can here, because I have somebody who
    can do something with it - that I can't do. And if
    I can't do something with that machine, then I'm not
    utilizing it, until I learn how to do it. And if I
    have someone who can utilize it - great!! In other
    words, if that person wasn't there that situation
    wouldn't get done and the computer would be
    underutilized.

Q   But is it important in terms of the students
    learning, or important in terms of the computer?

A   Both. Because the person who's going to benefit
    from this will be my class, or myself, and it's
    going to be important to the students, because
    whatever I'm going to use that for, I wouldn't have
    used it otherwise. But it's hard to put it in
    words, in the sense that if I had a computer-
    experienced person who can teach me to do something
    with that machine, then those kids are going to
    benefit, because I'm going to do it with them. If
    they didn't do that with me, or maybe directly with
    another student, then I haven't used what I have
    there to the greatest advantage. It might be using
    the video recorder, and not using it to play back
    and re-play again, or something like that. I'm not
    using it to the full capability of the equipment.
    I'm not using it to the full capability of the
    equipment. If I use this computer student who knows
    his business - sure, them I'm using the machine to
    its full capability.

      Mr. R. has found that some of his students know more
than he does about computers. Just what these students have
to offer isn't all that clear; what is clear is that their
potential contributions have to be managed somehow. The
ambiguity is that what the student can teach isn't clear and
since for Mr. R. management is the maintenance of the
momentum engendered by his own teaching, how to manage the
teaching of others becomes moot; either the teaching of
other students or of the programs on the machine.

He is clearly concerned that the computer be used to
its maximum capability however it isn't clear what the
nature of those capabilities are, but they have something to
do with the machine itself; just like the capabilities of a
VCR comprise things like re-play.

Like Mrs. M., Mr. R. is faced with a technology whose
possibilities are new. The rules of the game are not yet
established and what teachers are to do about it far from
established. The central question seems to be how much will
teachers need to know about it and that depends on what "it"
is. Just what sorts of things can be done with micro-
computers and which of those things are likely to be well
within existing classroom routines, which are at the margin
and which beyond the pale?

The problem of how to view the technology can be seen
in Mr. R.'s comments about the benefits   associated
with familiar machines. Mr. R. sees the computer as a new
kind of machine. Where it breaks down, it is like any other
machine. This view emerges in his response to situation
five.

Situation 5: [Teacher removing stuck diskette]. It is
interesting that Mr. R. sees a stuck diskette as similar to
a broken projector.

Q The teacher is removing a disk from the diskdrive.

A Yes. To me that's just basically just the same as
  the film projector breaks in the middle of the
  lesson. It's something you fix. If you can fix it

you go on. If you can't you stop, and go on with
something else. Like with the machinery back there
if I can go back and fix something quickly, O.K. If
it's going .t take an hour, then I say "I'm sorry
guys, it's down for a while. We're just going to
have to do without it." It's more like a mechanical
breakdown or something like any piece of audio-
visual equipment I would use. I didn't see it as a
very important item myself.

Q All right. You didn't relate it at all to classroom
management or formal teaching. Does it call for
particular procedures to be set up so as you know
what to do in those circumstances, or is it not
related to this at all?

A No. I just think that when they said I'm removing
it. To me it was just the kind of thing that - it
was just a mechanical breakdown. And normally, I
don't, in my classroom, I don't have the students
running the machinery. And it's the kind of thing I
fugre that when something breaks, and they say "Mr.
Walsh this thing doesn't work" and I say "O.K.
We'll try to fix it", and if we can't I say, "O.K.
guys we just have to leave it. You know, we just
don't have it for a while, if it's broken." That's
the way I look at it.

The stuck diskette was no more than like a broken film
projector. Having the computer "down" was just the same as
having the film projector "down" and to be handled in the
same way. If it could be fixed quickly then it would be;
otherwise abandon the plan and go on with somethin else.

Mr. R. saw the down situation as related neither to
formal teaching or management, just a broken machine, or
like a lost book. If it isn't there we will have to make
do. The interaction between child and machine isn't keyed
on here. The program on the machine isn't the focus. That
isn't what is down, but the machine itself. The program
isn't seen as "teacher" but as some kind of managed activity
dependent somehow on the teacher; just as a film is
dependent on the teacher. If the program were seen as

"teacher" then the stuck diskette would have implications beyond ordinary machine malfunctions.

This does not seem to be the way Mr. R. views the machine. The machine seems to be incorporated into an existing view of classroom aids for now, pending perhaps resolution of its possibilities for teaching that are yet unclear.

CONCLUSION

Both Mrs. M. and Mr. R. are concerned about instrumental matters. Can they ensure that work with the computer will have the same flow as other work they manage? Both recognize that they have to keep an eye on what is happening and that in Mrs. M's case more intensive monitoring seems to be required. In Mr. R's case the kind of intervention he sees demanded of him is similar to that of any other machine that needs "fixing" at times. Being stuck for him is being caught in a familiar technical problem. Both recognize that their own capacity to deal with the potential demands of the technology is in doubt. Some students understand the machine in ways they don't and it isn't clear what the boundaries are of a reasonable teacher capacity.

The computer is thus seen both as something old and as something new; teacher's pet and trojan horse. Pet in the sense that it is something they can treat as domesticated -- house trained. Routines which are familiar are extended to the computer; perhpas there is a bit of an edge to it but really nothing new. Students still have to be monitored as

before; rewards can be distributed as before; some
children can show their special talents as before; students
make unacceptable demands as before. Equipment still has to
be fixed as before; interesting new things can be
incorporated into the classroom as before. The computer is
domesticated.

Yet, there really is something there that isn't so
domesticated. There are potentials in the way the
technology can be used, as indicated by what some students
can do that the teacher can't do, that seem to be troubling,
and for which familiar patters of response may not be
adequate.

What to do if the students get really stuck and you can't
help? The way programs are made may make it difficult for
teachers to help their students. The "pages" of the
computer are not on view. How to assess the requests of
students for more of what is on the computer? Is the
computer just another adjunct of the teacher's teaching;
something to be managed as an auxillary? What if the
computer is teaching something the teacher doesn't teach?
What if the computer is asking for types of intellectual
activity the teacher doesn't stress? What if the student
asks the teacher for advice about what is going on in a
program thus placing the teacher in an auxillary role? Who
is managing whom in this case? Who is doing the teaching?
What does it mean to fully use the potential of the
computer? What is the potential?

Such questions seem unresolved. They are the trojans in the horse that threaten to undermine the sense of domesticity that having a pet engenders. It is hard to know how these matters will be resolved, but it is likely that at risk are the expressive elements of a teacher's work. How will teachers cope with threats to their standing in the eyes of their students as helpful, reliable people able to break up logjams, unravel knots and keep things smoothly running? How that question gets answered might give us some clue to understanding how computers actually get used by teachers in classrooms. Stay tuned.

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