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EDITORS

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Michael Cole

Introduction

Michael Cole

Each of the contributions to this issue of the Newsletter provide fresh insight into the complex socio-cultural processes which constitute human learning and development.

In the opening article, David Barton reports on the work he and his colleagues at the North West Regional Studies group at the University of Lancaster have been conducting on the history and current status of literacy in a part of England that has experienced economic difficulties for many years. As in many other industrialized countries, there is a perceived need to increase the literate and technological skills of the populace. This need is being addressed through a variety of adult literacy programs, but rather than restricting their activities to conducting adult literacy classes based on current notions of school-based literacy, the Lancaster group has been attempting to gain a deeper understanding of the culturally accumulated conceptions of literacy that exist in their communities and the many different ways in which print has effectively mediated their everyday activities. As the article richly documents, current practices are deeply embedded in traditions that reach back over many generations. Through an understanding of the variety of literacy practices with which adults are familiar, it is hoped that programs that speak more directly to the varied needs of the community can be organized.

Yasuko Kawatoko's article focuses on the other end of the age spectrum--children who are undergoing their initial exposure to schooling. Here we see a somewhat different approach to student-teacher interaction than has been fashionable in European and American discussions of the role of classroom interaction on academic development. Without in any way reducing the importance of teacher-student interaction, Yasuko-san highlights the role of lesson *content* in shaping such interaction by proposing the idea that both teachers and students are engaged in a coordinated dialogue with the *objects* of inquiry. The heuristic procedure she describes for how to ask questions and obtain answers from the dandelion, is simultaneously a very promising way to teach children the logical inquiry procedures that are classic models of scientific inquiry.

The next two articles shift focus slightly from questions about the everyday and classroom conditions that promote the development of systems of mediated activity to the problem of the contexts of observation used by psychologists for psychodiagnosis. Using somewhat different starting points, both Verdonik and

his colleagues and Hundeide illuminate the complex interpersonal situations that exist when psychologists set out to assess children's cognitive repertoire. Both adults and children come to such events with prior expectations and different rights, corresponding to their social roles. As both articles clearly demonstrate, the normative order of "standardized procedures" mask implicit social rules which play an important role in constituting the criterion behavior that then gets reported as a product of the child's behavior, rather than a product of the contextually constituted interaction.

As members of LCHC have argued for many years, blindness to the actual complexities of such testing situations is particularly pernicious when prior experiences of the children are systematically different from those presupposed by the standardized procedures. Interested readers might wish to follow up the current discussions by referring to earlier issues of the Newsletter or to Cole and Means, 1981.

The final article, by Hanson and Padden, reports on a project that relates to several recurring themes of the Newsletter: bilingualism, literacy instruction and new technologies. They have designed a program using videodisc technology to allow youngsters who have fluency in American Sign Language (ASL) and in English to use their bilingualism as an advantage for increasing their literacy skills. They report on their observations as children actively used the personal computer and videodisc to watch signed stories and read and write stories in English as well as to mix their language options in the service of comprehension.

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- Cole, M., & Means, B. (1981). *Comparative studies of how people think: An introduction*. Cambridge, MA: Harvard University Press.

Exploring the Historical Basis of Contemporary Literacy

David Barton
Lancaster University

Although compulsory schooling has existed in industrialised countries for a hundred years, there is continuing questioning of the levels of literacy exhibited by adults and children. With rapidly changing communications technologies, many countries are also re-

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examining the types of literacy necessary to meet the demands of contemporary adult life. Inevitably, the teaching of reading and writing is under renewed scrutiny. Within this social context, we are working to understand what literacy means to people in their everyday lives, what they use it for, and how it fits in with the rest of their activities. We view this task of clarifying the nature of literacy as a prerequisite to understanding the learning of literacy.

We see our work as part of a developing school of thought on the nature of literacy. In this view, the social meaning of literacy is of central importance and technical and functional aspects follow on from this. In brief, we argue that: We need to talk in terms of "literacies," not just one literacy; these vary by social context and are best described as practices or events, rather than as skills; this gives a dynamic and relativistic view where a historical perspective is essential, rather than a static model. We also argue that the dominant school-based definitions of literacy and work-based definitions of literacy are often at odds with the definitions people use in their everyday lives. Family, school, work and community are different domains of literacy supported by definition-sustaining institutions. We need to develop ways of talking about literacy in these different domains. Literacy practices and values within education have been described to some extent, those of family, community and work place, less so.

Most studies of literacy are concerned with children in educational settings. Only a few studies have begun to examine the role of literacy in people's lives, beginning with adults' actual uses of reading and writing and their attitudes to and awareness of literacy. One factor these studies have in common is that they do not start from the educational system and its definitions of literacy, moving out from this to other contexts such as work, the community. Rather, they begin from these everyday contexts and only later examine how these can carry over to the educational system.

The three main studies in this area are those of Scribner & Cole, Heath, and Street. Briefly, Scribner & Cole (1981) have studied literacy among the Vai of West Africa; they used a battery of cross-cultural psychological tests, along with interviews and observations of the community. They provide detailed descriptions of forms of literacy which are learned informally and which exist outside the educational system. Heath (1983) developed close ties with three Appalachian communities in the United States over seven years and used ethnographic and sociolinguistic methods to provide detailed descriptions of people's uses of reading and writing in the home and in the community. Street (1985) studied Islamic villagers in Iran; he lived there as

an anthropologist and carried out ethnographic field work. He has developed a theory of literacy and observed two literacies being used side by side in the community, one commercial and one not. He documents how the commercial literacy was taken up with the development of oil in the region, while the other, more traditional, literacy was not taken up. There are other smaller studies which contribute to this approach. Fingeret (1983) has studied adult literacy students and the social networks they establish, paying particular attention to different social roles people have. Klassen (1987) and Baynham (1988) have recently examined the uses of literacy in bilingual communities. Similarly, Reder (1985) has worked with Inuit and Hispanic communities. Levine (1985) has studied people with low levels of literacy and problems encountered in obtaining work. Taylor (1983) has used ethnographic methods to study literacy within the family. Other examples of research using ethnographic approaches are described in Schieffelin & Gilmore (1986) and Langer (1987). Elsewhere, we have examined the historical basis of literacy (Barton & Hamilton, to appear).

The Oral History Study

To understand contemporary literacy we need to understand the historical basis of people's current attitudes and practices. Contemporary literacy is constructed from its historical roots. In the study reported here we used data from oral history interviews. These data provide a unique viewpoint on the role literacy has played in the lives of a particular group of people. The strength of oral history data is that they provide a glimpse of people's lives, as recounted by themselves; this is a voice that is not often heard (inevitably in much historical work) and one that can usefully be compared with other views provided by official statistics or social commentators of the time.

One hundred and sixty people who were born around the turn of the century were interviewed about their lives. They were working class men and women from North West England (from the shipbuilding town of Barrow and the cotton towns of Preston and Lancaster). They talked about all aspects of their lives: growing up, work, leisure, family life, living through wars, etc. We have collected together what they said about reading, writing and education and we have used their words to build up a composite picture of the significance of literacy in their culture. From our point of view they are a particularly interesting group of people as they were part of the first generation of people to undergo compulsory schooling in Britain.

We can use this oral history study in two complementary ways. We can look at this "strange other cul-

ture" - working class life in North West England at the turn of the century - and see how it fits together, how it makes sense to itself. In doing this we come to see how literacy is socially constructed in a particular situation. Such comparative descriptions then have implications for how we view literacy in our own culture. The second way of using this research is more direct. We use it to trace a pathway from the last century to the concerns of today: these people are the parents of the parents of today's generation; their attitudes have had formative influences on today's attitudes and practices. This historical study is one starting point for the study of literacy in the community which we are currently carrying out.

Everyday Literacy 80 Years Ago

To give an account of these people's literacy, I will begin with their home lives, examine what reading and writing they did and then build up a picture of the social context of their literacy.

Firstly, the people interviewed had all been to school and could read and write to some extent; they were a schooled generation. However, often their parents were not literate. They give sympathetic accounts of their parents' abilities and do not attach any particular stigma to their parents' illiteracy; it was explained in terms of their lack of opportunity for schooling. (See quotes 1 and 2 at the end of the text. The full data of quotes on literacy runs to 90 pages. To make the text easier to read, I will only give a few examples in the text and I have listed other illustrative quotes at the end.) Often one parent was remembered as literate but not the other and some respondents were not sure whether or not their parents were literate. As we will see later, some recall reading to their parents from books or newspapers.

Most homes had few books; typically they were the Bible and other religious books. Religion usually had a central role in their upbringing, and this was an important context for literacy. If they had more books they recalled themselves or their parents reading novels, biography and technical information books. Sometimes these were received as Christmas presents, often they were Sunday School prizes. (Quotes 3 and 4)

Libraries were used extensively and there were several in any one town. At that time, as well as public libraries, there were private libraries which made a small charge. These were often located in shops or the post office, Sunday school or workplace. (Quote 5) However, one woman remembers her mother's hostility to the library:

My mother didn't agree with libraries, you got germs. You weren't allowed to join the library. (Quote 6)

People also bought books second-hand, borrowed from each other, and exchanged books at a stall in the local market. (Quote 7) These book stalls are still found in local markets today.

Newspapers featured prominently in their homes - often people took a national morning paper and a local evening paper. Significantly they did not count this as reading - real reading involves books. Sometimes one member of the family regularly read to the others from the paper. Although they took both national and local papers, the topics people recalled reading in the papers were sometimes national such as "where the troops were in the Boer War;" more usually local news was mentioned: births, deaths and marriages, the weather forecast, etc. (Quote 8)

With books, magazines and papers available, there was certainly reading in many childhood homes. This can be contrasted with the very little amount of writing that is reported. It was hardly mentioned, and what writing there was, was very functional. It was also noticeable that who counted as a good writer was someone who wrote neatly; this point was made by several people (e.g., Quotes 9, 10):

I used to be a good writer at one time! In them days it was two fingers on your pen. The teacher would hit you if you only had one finger on your pen. The down stroke had to be thick. You had to do it properly! (Quote 10)

Neatness was all that counted and there is no mention of the processes of writing such as composing. One image which came over strongly is that some people are born writers: Either you were or your were not "a writer."

When and what did people read? Reading was construed as a leisure activity, and many people report that their parents did not have time to read, except maybe on a Sunday. (Quote 11) The rest of the week when not at work or school parents and children were busy with housework. One woman in a family of nine children recalled her sister being "a reader" and neglecting household chores. It was not work but it was better than doing nothing:

I had a 13-year-old sister at home but she neglected things as she was a reader and she would read these novels... She used to stay at home and she would start the washing on a Saturday morning after being at home

all week. We had a coal fire then and she would have the ashes out here while she had been reading the novels. (Quote 12)

A recurrent theme in people's recollections was that their parents controlled what, where, and when they read.

If there was anything to do we had to do it rather than read, but she would rather we read than did nothing. But she didn't make it a priority. (Quote 13)

Papers, especially Sunday papers, were heavily censored in the childhood home. Sometimes all books were vetted, but more often particular types of books were acceptable, such as only religious books. Most novels were unacceptable as were comics (Quote 14). Library books were vetted and even returned to the library if they were deemed unsuitable. Children responded spiritedly in what must be universals of literacy - they hid books and they read in the two places of privacy in the Western family, the toilet and under the bed covers.

In the social aspects of literacy, one common phenomenon was the asymmetry of literacy skills and how this affected the roles people took. Then, as now, literacy was not spread evenly through society. Firstly, within the family people often recalled one parent being able to read and write but not the other. Often it was only the father who read, but sometimes it was the mother. When only one person was literate, this person would take on roles which needed literacy (Quotes 15, 16):

Mother didn't go to school. Taught herself to read and write. She did everything, all the corresponding in the household. (Quote 16)

Sometimes they recalled that they used to read to their non-literate parents. Often it was mentioned that a non-literate person had other skills, such as numeracy. Clearly, the one skill was not dependent upon the other. (Quote 17) Beyond the family, people remembered their parents doing writing (and reading) for neighbors. (Quote 18)

They in fact often learned to read and write from each other, with relatives, with neighbours, at work, in church. One person recalls her father, a postmaster, actually teaching his customers to write, with the introduction of pensions (in 1909) which had to be signed for. (Quote 19)

The significance of literacy for these people was that it helped them in their everyday lives. They valued literacy where they could see a use for it:

They tried to make me read but I didn't see it any good to me, but now I miss it. I should have done. I quite agree learn what you can while you're young and this is where I tripped up. If I'd have known the world was going to go as fast I would have been different today to what I am. Learn while you can, it's a fool that doesn't. (Quote 20)

They did not particularly talk about literacy in relation to their jobs and they did not attribute having jobs to literacy. The modern gloss I would put on it was that their literacy was functional, but that it also enabled them to cope with change, and go beyond their current lives. As a shuttle maker born in Preston in 1896 put it:

It didn't get me anywhere, but it learnt me a lot. (Quote 21)

Lastly, you can see throughout an ambivalence towards the power of literacy. It is a form of exploration; it is exciting but dangerous:

...it runs in my mind that they were putting things into your head because they weren't in our class. (Quote 22)

...if you started reading books, where would it all end! (Quote 23)

Contemporary Literacy

These findings can act as a starting point for examining contemporary attitudes toward and beliefs about literacy. We are studying contemporary uses of literacy in the family, broadening out to cover community uses of literacy, and relating it to the domains of work and education. In our work we are particularly interested in the significant minority of adults (around 10% according to Hamilton, 1987) who experience problems with literacy. We are using ethnographic methods to find out what people read and write in their everyday lives, how they make sense of literacy and how it fits into the rest of their lives. There are hundreds of questions to ask and details to observe. From the oral history study and from our theoretical approach we have identified 5 themes to group our questions around:

Values. There are a range of moral and social values attached to literacy. This is reflected not just in views about censorship of literacy materials but also in the relative value attached to literacy as compared with other domains, such as practical and physical activities.

Roles. The asymmetry of literacy roles across people needs to be examined and peoples' assumptions

about what are appropriate or proscribed activities for themselves and others.

Networks. We should map the social networks of support which exist and the informal learning which takes place; we are particularly interested in this where people identify problems with literacy related activities.

Contexts. Literacy is embedded in other sources of information exchange; it is often one option among others for achieving a given communicative goal and patterns of choice may vary from one individual to another. Literacy is also embedded in institutional contexts which shape the practices and social meanings attached to reading and writing.

Access. People vary in the extent to which they have access to literacy and in the control they have over literacy; patterns of borrowing, sharing and ownership of books and other literacy materials are important. Literacy provides a voice.

We intend to use this framework to explore continuities in changes from the past to the present. We hope that it provides a richer way of talking about literacy. It identifies significant themes which need to be incorporated into any theory of literacy.

Sources and Additional Quotes

1. p.21 S4L

Q. Did your father ever have a newspaper?

A. Yes, they used to get a newspaper. There used to be a newspaper, used to come out on a Friday, like the Lancaster Guardian does now, but they called it the Lancaster Observer, and my mother always had that and I used to have to read that to her. I read it word for word to her. I used to have to read that to her.

Q. Could your father read?

A. No... my father could sign his name, and that's all. When he signed it was beautiful writing but they never went to school. I mean there was not schooling in those days, I mean.

2. p.51 P1P

When my mother was young, she went to work at eight years of age...they said the teachers weren't much older than them, they were only 12. She couldn't read or write. It was very sad in them days because you couldn't afford books or anything.

3. p.31 G3P

Of course, when you did get a Sunday School prize you took the trouble to read it because it had taken you 12 months to acquire it...they were always on about this demon drink, what happened to urchins who sat outside on the front doorstep while their parents were drinking and now they were deprived of shoes on their feet, then how the lad vowed he would never drink, sort of like turn again Dick Whittington. All the books that you got were like that.

4. p.6 H2B

A. Yes for birthday and Christmas. You perhaps got a book in your stocking or something like that and prizes from Sunday School. Mother and Father and Grace belonged to the PSA, Pleasant Sunday Afternoon, and they got prizes for that. I can remember one that m'sister got and it was called Florence Silverdale. I remember reading that book when I had influenza very bad and I cried my eyes out. After that my sister wouldn't part with it. Oh no, I'm not parting with that, May likes that book and it was in her house as long as she was so who has got that now I don't know. I remember crying. It was a girlish story but one of those that you could weep and did I weep. Mother threatened once or twice to take it from me but I still got it.

5. p.25 B7P

...I remember my grandmother used to read a lot, or pretend she did, and all the family had tickets at the library. So I could go to the library and get five books for grandma. I used to go to the entrance where the books were all set up and I would just pick up the first five books and take them up to the counter and give them the tickets. I would come home with five books and I would take them along. "I think I've read this one before but I'll read it again." She was a real character.

6. p.57 W2L

7. p.33 C1B

Q. Can you remember what your mother did with spare time in the house, Mrs. C.1B.?

A. I don't think she ever had any. She was a great reader when she could read. She used to read library books and sometimes in the market you used to get paperback books very cheap, only coppers.

(Mr.) Comics were all the rage. You could buy comics for ha'penny. If you were well off you could get a twopenny book, value for money. Comics were all the go in the market and the kids kept changing them.

(Mrs.) You could get quite good paperback books from the market. I can remember that if you went for them the boy had a big long handle and a tin scoop and the book came on that and you put your money in the scoop. They had them on all the market stalls then.

8. p.65 M10B

Got Daily Mail in the morning, Evening Mail at night. Sunday paper. With Dad being in bed we used to try and get the paper ourselves and you'd go creeping up the hall and he'd know what the time was and you'd be standing there reading the paper and he'd shout "Fetch that paper up." He knew very well what time it was and he had to have the paper first. You couldn't have a bit of paper until he'd read it. We used to be saying "Have you finished with the middle yet?" "Have you finished with the outside?" You used to read it like that, the front and the back and the inside so that we could dole that piece out.

9. p.79 H3B

I've heard it said that my father's writing of shorthand could be read by anybody. You wouldn't think that human hands had touched it. He was an artist with a pen. Bert, my brother, could also come under this title as his penmanship was truly magnificent. I'm talking about brains now, my brother and I could read and write before we ever went to school. I went for a job at Vickers. I saw this man...he'd got my application and he said, "Might I ask you who wrote out that application?" I said, "You might, but you're speaking to the person." Do you know I was insulted. He said, "Well, the writing," I said, "I wrote it and that's it," and I walked out of his place and I went to the Steel Works.

10. p.80 B4P

11. p.3 B1B

The only time m'mother used to read was Sunday afternoon. She was always working, looking after the family, but Sundays, no work on Sundays, nothing had to be done. After Sunday dinner mother used to get those little books like Home Chat and she'd read those and St. Mark's Church magazine.

12. p.41 W1P

13. p.42 W3P

14. p.42 W4P

Q. Did your mother ever read? Was she a reader I mean?

A. She couldn't read, she wasn't illiterate but she couldn't sit down and read books, because she had always been brought up in a public house and they opened at six and they didn't finish while eleven, so she never had time to sit down and read. We were all big readers as we took after our dad. I always remember...this particular night, the front door was closed and we were all sitting around the fire with our books and our mother had to come up the back way, we never bothered when she came in, we all just sat reading. Then, up went all our books! One went in the fire and it was our Authur's and that was a library book. It would have to be a library book that went in the fire...

Q. Did she say anything when she hit them all?

A. She say, "You are as bad as your dad. I've been knocking and knocking."
She would say a lot of things...we were very big readers.

15. p.49 T2B

Q. Did you know a lot of old people who couldn't read or write?

A. None of them could. I used to go and read the letters for many a one in Hindpool. They were old married women.

Q. Did your mother write letters for them?

A. She did for all of us. Any letters that were written m'mother always wrote them because she was a beautiful writer, she used to do lovely writing.

Q. She didn't do it for the neighbours?

A. She would if they wanted it. She did it for a few neighbours. But they didn't do much writing.

16. p.20 R2L

17. p.53 S4L

Q. Why did your mother never go to school?

A. I think they had to pay to go to school and it was probably too expensive. She couldn't read, she couldn't write but reckon money up you couldn't beat her. You couldn't have diddled her out of a ha'penny.

18. p.48 M6B

I've heard people came round, "Could you sign this document for us," they've only put a cross on the things. "Could you read this for me?" There used to be penny

readings and they could take it in when you read to them, but they couldn't pick it up themselves. It was dying out - but the trouble was you had to pay to go to school.

19. p.51 J1P

My father taught lots of people to read. When the old aged pension first started a lot of them couldn't write so he taught a lot of his customers just to write their names so they could sign their pension book.

20. p.21 R2L

21. p.40 T3P

22. p.30 F1P

23. p.26 B9P

Note

The data are part of the oral history material collected by Elizabeth Roberts and housed in the Center for North West Regional Studies, University of Lancaster. I am grateful to Janine Floyd for assistance in collecting together the material on literacy. This research is one of the activities of the Literacy Research Group at Lancaster and the ideas have been developed in regular discussions with Mary Hamilton and Roz Ivanic.

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The Role of Communication During Classroom Lessons in Cognitive Development

Yasuko Kawatoko
Daito-Bunka University

In modern societies, the role of school is so enormous that it would be safe to say that it carries the responsibility for children's cognitive development. Everyday classroom lessons are directly connected to human development. Through analysis of classroom lessons and communications, researchers have opportunities to examine the effects of social interaction on cognitive development; how reciprocal activities impact the development of thought and how group interaction effects the formation of an individual's concepts. In this sense, classroom lessons are treasure houses of information about development.

Classroom lessons also give us insights into the structure of conceptual knowledge and the processes by which individuals acquire that knowledge. In psychological discussions of concept formation the process of acquisition is often discussed but the content of the concept is ignored or it is detached from the condition of its acquisition (e.g., via social interaction). The socio-cultural perspective on human development has demonstrated that individual knowledge is socially con-

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structured through the mediation of language, persons, and material reality.

In school settings it is quite natural to assume that the content of educational materials exerts an influence on the kind and quality of social interactions intended to teach a given concept (as represented by the contents of the materials themselves). In this article I will use the concept of "communication" to represent the process of cognitive development, or more appropriately, the process of concept acquisition in dynamic learning situations which include both the materials and social interactions which comprise the process.

Three Kinds of Communication in Classroom Lessons

Generally speaking, classroom activities are recognized as a process of communication between teachers and pupils, mediated by teaching-learning materials (Hosoya; 1983). Hosoya also holds that there are three kinds of communication in classrooms; communication between teachers and materials, communication between teachers and pupils, and communication between pupils and materials. These different forms of communication are considered to be causally inter-related. That is, the better teachers communicate with materials, the better they can help pupils communicate with the materials also. The better the pupils communicate with materials, the more profoundly they can comprehend the materials, create new questions about them, and pose those questions to their teachers. This, in turn, helps teachers to facilitate the study of materials and to communicate with children using the materials more profoundly. When these three kinds of communication are working in synchrony, in a kind of dialectic, during classroom lessons, then both pupils and teachers develop cognitively.

In order to create good relationships between the three communications systems, teachers have to become acquainted with teaching materials and pupils' way of thinking. To put it more symbolically, teachers have to master the language of the materials and the pupils.

How to Communicate with Materials

When you want to know whether honeybees have a color sense or not, or why tanpopo (dandelions) close their petals in the evening, what will you do to find the answer? It is not so difficult to get an answer from objects, if only you have a good way to ask them. Let's think about the instance of tanpopo. Tanpopo usually close their petals completely in the evening. Is it caused by light? Or is it due to temperature? In order to test the prediction about light, you place the tanpopo in darkness without changing the temperature. If your pre-

diction and your way of proving it are right, tanpopo will give the answer "yes" by closing their petals. Once you get to know the relationship between closing petals and light, you would be able to listen to tanpopo's murmuring on a cloudy day, "It is dark. I need more light."

Thus, in order to communicate with materials one must make predictions about which variables are likely to have something to do with a given phenomenon and devise ways of testing the predictions. Through actual examinations (including mental experiments), you will learn the functional relationships (rules) between variables.

Objects exist in nature as part of the world and are never isolated but always related to other objects. This means that they are always under the control of rules. Inevitably, rules have exceptions since nature and the world are still too complicated for human beings to comprehend completely. Accordingly, the basic principles for communicating with materials is to become aware of the principle that objects are always connected by rules and that those rules always have exceptions.

The study group, Kyokuchi (named after a method of polar exploration), which consists of Japanese teachers and researchers, explores teaching materials from the above perspective. They begin by talking to the material and developing a rough, simple and easily understandable rule. Then, they use the rule repeatedly, applying it to different kinds of instances and making sure of its validity. Because of its roughness and simplicity, there is soon a need for developing exceptions to the rule. When this occurs, the exceptions are used as a lever for the next step, to make up a more detailed rule satisfying those exceptions. The process of exploring materials is demonstrated by the following example on the conduction of electricity by metals.

1. Make up a rule from familiar phenomena. "Electricity is conducted by copper wires. Iron wires also conduct electricity."-----"Metals conduct electricity." (Rule 1)

2. Use the rule repeatedly to validate it. "Does copper dust or copper grain also conduct electricity or does a liquid metal like mercury also conduct electricity?" "Natrium and Calcium are metal, do they conduct electricity?" "Natrium and Calcium conduct electricity, are they all metals?"

3. Testing the exception to Rule 1. "Oxide of copper does not conduct electricity. Oxide of iron does not conduct electricity."

4. Augment Rule 1 and make up a new rule. "Metals conduct electricity, but the rust of metals does not" (Rule 2)

5. Proceed, using Rule 2. "If rust is removed from metals, it should conduct electricity."

This approach to materials is applied to teaching. Eventually, it is expected to become the pupils' way of communicating with materials.

How to Communicate with Pupils

It might seem easier for teachers to communicate with pupils than to communicate with materials, since both share a common human language. It is not true, however. There are many cases where even if the words that both teachers and pupils speak are the same, the meanings or the background ideas are quite different from each other. Nagano (1977), demonstrates this point through his numerous examples of student interactions and responses to problems.

He presented several questions about "the extension of a spring" to elementary school students. One question was, "If the weight of the plummet becomes three times heavier than now, how much will the spring extend?" (See Figure 1). More than 80% of the students gave the correct answer, "Three times longer." For the purposes of examining whether they really understood the relation between the weight of the plummet and the extension of the spring, he asked another question; "Which spring will extend longer, (a), (b), or (a) and (b) are the same?" (See Figure 2). The number of correct answers to this question decreased drastically. Their answers were divided between (a) and (b). These results indicate that their correct answers to the first question are very shaky and doubtful. The correct answers might have resulted from the fact that the students were familiar with a general notion of proportional relationships or they might have felt that "three times" sounded good. The point is that even when students' words look like those of the teacher, they do not always reflect the teachers level of understanding.

Nagano also asked questions such as, "Which spring will extend longer? Choose one correct answer from (a), (b) and (c): (a) spring a will extend longer than b, (b) spring b will extend longer than a, (c) springs a and b are equivalent." (See Figure 3). The rate of correct answers for 4th graders was 13% while 74% gave (b) as the answer. Even among eighth graders (the second year of middle high school) the rate of correct answers was less than 60% with 33% giving (b) as the answer. Here,

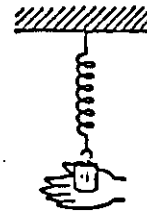


Figure 1: Question 1 about the extension of spring

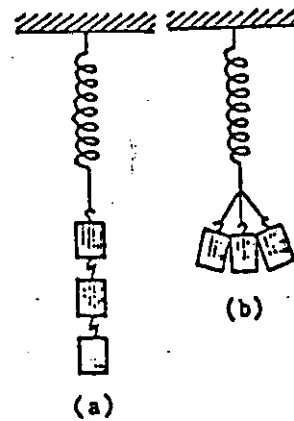


Figure 2: Question 2 about the extension of spring

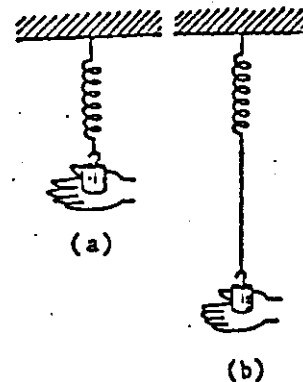


Figure 3: Question 3 about the extension of spring

the important thing to consider is not whether they chose (a) or (b) as answers, but their reasons for the answers selected. Those who said that spring (a) would become longer than (b) said that just as sound was weakened when it was conveyed over long distances, so would physical force be weakened when the weight was hung at the end of a long string. The others who answered that spring (b) would become longer than (a) said that just as it was harder to pick up short grasses than

long ones, physical force would not be conveyed in a short distance. From the students responses we learn that they have tried hard to figure out how physical force works by referring to their past experiences. The collections of incorrect responses are proof of the fact that students think about things in their own way. Therefore, it is critical for teachers to search for students' incorrect responses so that they can communicate effectively with them. The incorrect ideas of students are deeply rooted in their daily experiences.

Importantly, children may apply their rule systems to other phenomena, where the objects are connected with each other to make rule systems in an analogous way. For example, the student who thinks that two blocks are heavier when they are put one upon another on a scale than when they are put on separately, also thinks that two people are heavier when one carries another piggyback on a scale than when they stand on it hand in hand. In such cases it seems as if the student believes that when things are piled up on a scale then the scale pointer will reflect this difference. Moreover, this incorrect rule often connects with another incorrect rule such as "the heavier the thing is the faster it falls." As a result, he infers that two people will fall faster when one person carries another piggyback than when they fall together hand in hand.

All of us, not only children, have a lot of incorrect ideas and rules about nature and the world. It is partly because we are all inclined to generalize easily from a few phenomena encountered in the context of narrow, biased, personal experiences and then apply these generalizations to a wide range of phenomena. In order to communicate with students appropriately, teachers have to infer their incorrect ideas and rules as much as possible and examine them in appropriate task situations.

Communication Between Students and Materials

It is well known that Vygotsky (1978) categorized speech into external speech (inter-personal communication) and inner speech (intra-personal communication), and claimed that inner speech developed from the process of transforming and internalizing external speech. Hosoya's (1983) interpretation of Vygotsky is that first, an individual develops the ability to talk about objects, helped by other people's interpretations, and then gradually he/she becomes able to communicate with objects by himself or herself.

At the time when students start talking to objects, they need their teacher's help. As a matter of fact, it is the teacher's way of helping, especially the types of questions they ask, that greatly influences the students

own communication with objects. In general, teachers' questions are classified into "Why-type" and "How-type" questions. "Why-type" questions expect students to respond verbally about related factors and their relationships. On the other hand, "How-type" questions expect students to take an action toward objects, aimed at realizing the specific objective of the subject matter. Here, taking an action toward an object implies not only real actions but also thinking.

Fushimi (1986) gave students "the period of pendulum" problem in a lesson showing different periods of a pendulum; "Why does the period of pendulum vary in different conditions?" He wanted to know what factors determine the period of pendulum. He did not get any responses to his question from his students. He thought about it and then changed the way of asking to "How can we give more swing to the pendulum?" The students gave a lot of responses to this question. Some students answered that the string should be made longer and others gave opposite suggestions. Some also answered that the bob should be made heavier (or lighter), or make the string thinner or give the pendulum a more powerful push, especially at the beginning, etc. This episode indicates that it is easier for students to generate their own predictions (ideas) in response to "How-type" questions. Their predictions might sometimes be incorrect and irrational, but they are nevertheless the students' own predictions. Once they have their own predictions it becomes easier for them to act on or communicate with objects. Moreover, through these interactions, it will become easier for students to examine their own ideas and to recognize which factors are relevant, and to be able to grasp the functional relationship between factors.

Hosoya and Nagano (1971) gave the name "constructive" or "manual labor" questions to "How-type" questions. They claim that if teachers provide appropriate task situations accompanied by "How-type" questions to students, they will actively interact with objects, showing much greater interest and participation in the learning activity. The important point is that the task situation should be created by teachers such that the children can draw out their own ideas, talk to objects generating those ideas, and get the answers from the objects by themselves. As the following example of students' ways of thinking in group discussions shows, communication with objects is internalized into minds when it is successful, and becomes a powerful bridge for forming a higher level of scientific knowledge which students can share with other people:

"In many cases the roots of plants seem to extend underground."

"Are there any roots which extend up toward the sky?"

"The SAGUARO is a huge cactus which extends its roots near the surface of the earth rather than underground."

"But why do many kinds of plants extend their roots downward, underground?"

"Because the gravity of the earth has the root of them extend underground."

"If we were to add a horizontal force to a plant pot, will the root of the plant grow obliquely rather than downward, underground?"

"If we do an experiment on germination in a space shuttle, will the root get lost?"

"In fact, the young root extended in all in all directions in a space shuttle, and resembled the mane of a lion!" (Hosoya, 1983).

Through examination of three kinds of communications which take place in classroom lessons, we saw that three factors (teachers, students, and materials) play an alternating mediational role in each of the communications. The conditions of the materials have a great influence on the interactions which take place during the teaching-learning process. That is, deep understanding of materials by teachers facilitates the communication between the students and materials, which in turn promotes active inquiries about the materials on the part of students, leading them to ask new questions of the teacher, stimulating his or her own investigation of the materials and how the structure and character of materials effects the communication between teachers and students.

Hopefully, researchers will accumulate more information, through case studies, about the relationships that learning materials and social interaction have to cognitive development in classroom lessons. The current interest in the impact of computers on school learning should be examined from this perspective as well. It would be most interesting to examine the role of the computer as mediator and what it is supposed to be mediated simultaneously.

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The Role of Power Relationships in Children's Cognition: Its Significance for Research on Cognitive Development

Frederick Verdonik
Valerie Flapan
Cynthia Schmit
Jill Weinstock
University of Michigan

It is evident from the research literature that children do assume, participate in, and contribute to power roles with adults and peers in various activities such as family life, school, work and play (Alston, 1986; Coles, 1986; Cook, 1986; Dodge, 1986; Erikson, 1950; Hoffman, 1960; Jupp, 1986; Ryan, 1972; Whitaker, 1986). These relationships are culturally and historically specific (Aries, 1962; Schirmer, 1986). The aim of this paper is to explore the significance of power relationships for understanding children's cognitive development.

Within the present paper, a power relationship is defined as having control, influence, authority, and/or command over others (Adler, 1964; Fanon, 1968; Hoffman, 1960; Holt, 1974; Sigel & Kelly, 1986). Its significance for researchers of cognitive development is summarized as follows. Descriptions of children's cognitive performances may sometimes reflect social control in how children display and/or develop cognitive competencies in their interactions with adults, rather than reflecting a fixed individual quantity of cognitive ability or development.

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However, with few exceptions (e.g., Dillion, 1982; McDermott, 1988; Sigel & Cocking, 1977; Sigel & Kelly, 1986), the mediating effects of power roles on children's cognition and development have not been examined in detail. Yet, researchers must consider children's power relationships with others when interpreting the meaning of children's cognitive performances and development. For example, the degree of children's power over when, how, and with whom they interact, and the content of these interactions may mediate the cognitive competencies that are manifest in their interactions, and the competencies that eventually develop. Indeed, failure to understand how cognition operates in power relationships may result in under estimations of children's potential for cognitive development.

Children's power relationships vary in their opaqueness to researchers. The effects of power roles upon children's cognition are sometimes evident when violations in expected power roles occur. In the present paper, an examination of violations in power roles is exploited as a research strategy to illustrate the potential effects of power relationships on children's cognition. Two exemplary case studies of mothers and their children trying to remember information in a social interaction task will be presented. Although a limited number of cases are described, instances of power relationships were frequent for the entire sample of 32 mother-child dyads.

A model building task was used to observe power relationships. Children and their mothers were instructed to represent, with blocks, places that exist in their neighborhood. A 6' x 6' white, plastic sheet served as both the surface and the boundaries to make their model. The use of memory was a necessary means to complete the activity. First, instructions to build eight places that exist in their town required the use of memory. Second, participants had to recall some physical attributes of each place when representing that place in their model. However, which places they constructed, the locations of these places, the amount of detail in their representations, and whether they carried out the activity together or independently were determined by each dyad.

The social interactions between mothers and their children in the modeling task were videotaped. Verbatim transcripts of verbal and non-verbal behaviors were derived from the videotapes and used for the case studies reported below.

Examples of the Effects of Power Relationships on Cognition

Asking questions is one method used by adults and children to control the content and processes of discourse (Dillon, 1978, 1986; Sigel & Cocking, 1977). In the following example, an analysis of question-answer sequences is used to illustrate how a mother and child may control and command the memory processes and productions used to complete an activity. The dialogue begins with a 7-year-old child initiating a social exchange by asking his mother to remember a place in their model town.

(T stands for Turn)

- (T1) C: What's this?
(Child points to a previously made place)
- (T2) M: What's across from the drugstore?
(Mother refers to the place that they were making, which is across from the place of interest to the child.)
- (T3) C: Across from the drug store? I don't know.
- (T4) M: You told me the first time. I'm not gonna tell you unless you remember.
- (T5) C: What did I say?
- (T6) M: Don't know? You can't ask me that.
- (T7) C: Let's see. What is that darn thing?
Well...(Pause)
- (T8) M: You told me in the beginning. That's why we put it there.
- (T9) C: Well, I forget.
- (T10) M: Across the street from the drug store, what do you get? What's over there?
(Mother points to a location in the model.)
- (T11) C: The little market.
(Child says it boldly.)
- (T12) M: Okay. (Pause) Don't talk like that
(Mother refers to the child's tone of voice.)

The power roles were explicitly established and imposed by the mother. The child tested yet eventually accepted these roles. For instance, the child's initial request for help (T1) offered both a goal of remembering and a means to reach the goal. He expected to share both of these with his mother. The mother accepted the child's goal of remembering the "little market" (T2). She re-presented his memory goal in a question form, but she implicitly rejected her role as the direct source for remembering (i.e., telling him the answer). Instead, she transformed his role as a questioner to a re-

spondent and regulated the information that he needed to reconstruct the name of the place.

When the mother intervened to help him recall, it was on her terms. In so doing, she controlled his participation and became a resource for remembering. Specifically, she asserted her control by giving him temporal cues about his initial recall of "the little market" (T8), by giving locational cues about the other places in the model (T10), and by giving activity cues about his experiences (T10). Thus, the mother's responses (T6) created constraints on how he could use her to facilitate his recall.

Germane to the concerns of developmental researchers, it is suggested that power roles regulate the social processes of recalling. Cognitive behaviors observed by researchers, and used as indicators of age differences, reflect cognitive skills that exist within specified power roles. For instance, in the previous example, the mother explicitly defined what processes and answers generated by the child were socially permissible, valued, and appropriate. The 7-year-old wanted to use his mother as a direct source of the memory, while the mother restricted her participation as a resource to help the child recall. Moreover, what children do not say or can not say are critical considerations for researchers. For instance, it may not be permissible for children to question an authority's motives for not telling them an answer explicitly. Consequently, adults' control over children's information processing, which occurs over the course of their interactions, may constrain the memory processes and products observed by researchers.

The previous example raises an important dilemma for researchers' interpretation of question-answer sequences that occur between adults and children. Adults may experience their power roles as genuine because they believe that children need guidance for their development of cognitive competencies (McGillicuddy-DeLisi & Sigel, 1982). Telling children the answer is perceived by adults as detracting from children's "educational experiences." Yet, children may wonder why adults sometimes refuse to answer their questions when it is evident that adults know the answer. Furthermore, children may wonder why they must answer the adults' questions in these situations. As suggested in the previous example, the power dynamics of these interactions may affect the memory processes between children and adults, and the meaning of the memory products yielded through these interactions.

As indicated above, children's experiences of adults' control and influence techniques may be different from the adults' positive intentions. The following dialogue

serves to illustrate a 4-year-old's confusion when his mother assumed an observer's role, while he was given the responsibility of completing the task, and the consequences of this confusion on the memory processes displayed between them.

- (T1) C: That's where the Garfield is goin' to
(Child points to a location across the plastic).
- (T2) M: Alright, so move it (suggests that the child build Garfield Street at the location where the child pointed) You start and then I'll...
- (T3) C: Why?
- (T4) M: I wanna see how you're gonna do it.
- (T5) C: I wanna...I wanna...You know how the Garfield is.
- (T6) M: Alright. So what should we do?
- (T7) C: Build Garfield.
- (T8) M: What should we do then? Come on start me.
- (T9) C: Okay.
- (T10) M: I'm having trouble starting. Start me.
- (T11) C: Here. Now this.
(Child places blocks in target location)
- (T12) M: Okay.

Similar to the example of the 7-year-old, the mother of the 4-year-old immediately created a division of labor which delegated responsibility to the child for building and remembering (T2). However, in contrast to the 7-year-old, the 4-year-old questioned his mother's role as an observer. He requested an explanation (T3) and the mother stated her intention to observe his building activity (T4). Yet, the child remained puzzled about her directive for him to build and her role as an observer. In stating that she knows Garfield Street (T5), the child implicitly challenged the motivations and authenticity of the mother's role in the activity (T5). In responses (T6 & T8), the mother used the term "we" to restate their commitment to a shared goal to remember and build things on Garfield Street. However, once again she delegated to the child the responsibility for building and remembering the places on Garfield Street (T8). This time the mother claimed that she did not know how to start (T10). As indicated by the child's final acceptance of the division of labor (T11), this rationale permitted the mother to resume her roles as questioner and observer of the child, and also to establish the authenticity of her motives.

The previous example illustrates an important point for researchers of children's cognition: young children can and do respond to the authenticity and legitimacy of adults' control. Children's "failures" to respond to adults' directives and/or guidance may reflect

children's interpretations of these regulations as needless controls or annoying intrusions. For instance, similar to the example of the 7-year-old, the mother and the 4-year-old were disputing the processes for building. The child wanted to build Garfield Street as a conjoint effort, while she wanted to watch or supervise him as he built Garfield Street. The 4-year-old questioned the mother's initial directives when her motives were suspect. However, he carried out her subsequent directives to "start" Garfield Street when the mother offered a functional explanation for her directive -- she was having trouble starting.

In the larger picture, adults frequently delegate responsibility for cognitive processes and the types of cognitive demands encountered by children in an activity (Wertsch, McNamee, McLane, & Budwig, 1980). In doing so, researchers must recognize that the power roles assumed by adults and children also regulate the observable indicators of children's cognition and, thereby, color researcher's interpretation of children's competencies.

Implications for Socio-Emotional Development and Cognition.

Children sometimes experience power assertions by adults as rejections or oppressions of their creative thinking. These experiences may gradually affect children's perceptions of their cognitive competencies. For instance, adults frequently control the information taught to children, the materials used to instruct children, the forms of evaluating children's competencies, and the tempo of learning and evaluation. Children are socialized to expect and conform to these controls during their participation in educational processes. Children rarely have direct power even to negotiate the physical, psychological, or social resources related to their cognitive endeavors. In sum, children lack direct power to change or extricate themselves from educational settings that they experience as unpleasant and frustrating.

Children's reactions to power assertions may vary across situations and over time. For example, in extreme cases, children may inhibit their displays of creative or unique cognitive competencies. Children may learn to cope by suspending their attempts to initiate inquiries, by limiting their responses to the inquiries of others, or by acting out and opposing the contributions of others. These behaviors may function to protect their status and confidence in their cognitive skills and potentials. Hence, coping strategies that suppress the expression of cognitive competencies complicate the tasks of measuring and interpreting children's cognitive performances.

Some coping mechanisms may also function to mask the expressions of cognitive competencies. They permit cognitive competencies to be covertly used to complete an activity. For example, explicit expressions of cognitive competency may place children in jeopardy of ridicule by peers. In response, children may develop communicative styles that are more subtle forms of expressing cognitive competency. These subtle forms may appease a teacher's evaluation of cognitive performance and peers' evaluations of compliance to authority.

Children's tacit expressions of cognitive competency may also work against them in particular evaluation contexts. For example, a teacher may not accept or comprehend a child's display of knowledge. Alternatively, standardized assessment procedures that demand explicit forms of cognitive performances, processes and development may not detect subtle expressions of competency. In these and other cases, evaluators must be sensitive to differences in children's expressions of competency. Failure to recognize subtle expressions of competency may result in under estimations of a child's cognitive performances and potentials.

Implications of Researcher-Subject Relationships for Cognition

Researchers create various social constraints upon participation in research tasks (Adair, 1973; Spradley, 1980; Verdonik, in press). These constraints on subjects' participation make sense to *researchers* within the context of their research questions. Yet, children may not share our enthusiasm and understanding for experimental controls. Children may experience experimental controls as oppressive to their creative cognitive endeavors. For instance, in the present study, mothers sometimes reminded their children about the need to make real places, to stay on the plastic, to behave in front of the camera, and to limit the amount of details included in a building. Moreover, experimental controls may frustrate children's efforts to use their everyday cognitive strategies. Examples such as these attest to the control of the researcher over the power relationships observed between participants (Mahoney, 1976; J. Meacham, personal communication, July, 1987).

Researchers have dual roles in the research context as observer and observed. Indeed, there are many discussions of and studies on observer-observed roles (Hare & Secord, 1979; Dewey & Bentley, 1949; Rosenthal, 1966; Cicourel, 1978). Yet, these caveats about observer effects are frequently not heeded in practice when conceptualizing research methods and interpreting results. For instance, the terms "free play" and "spontaneous productions" suggest and independence

of participants from social constraints created by experimenters in research contexts. These terms conceal the rules for appropriate behavior that all researchers communicate to subjects in one form or another. The constraints themselves are frequently transparent to researchers and are surplus to the explicit controls that are hypothesized to affect participants' cognitive processes. Hence, researchers risk misinterpreting observed behaviors as solely attributable to limitations on individuals' level of cognitive development, to limitations on individuals' repertoires of cognitive processes, or to individuals' preferred cognitive styles.

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Metacontracts for Situational Definitions and for Presentation of Cognitive Skills

Karsten Hundeide
University of Bergen

Within the last 10 years more and more evidence has accumulated pointing in the direction of a more social and culturally oriented interpretation of cognitive development (Donaldson, 1977; Shotter, 1984; Wertsch, 1985).

Some of this research has shown that children are extremely sensitive to what could be described as the

"social logic" of the experimental situation - which means that the child is not only focussing upon the problem as it is presented by the experimenter, but he is maybe more concerned with the "metaproblem" of the situation: Why am I here? What kind of situation is this? Why does she ask these questions? What is my relationship to this person? Does he like me? What kind of answer does he expect? What will happen if I give the wrong answer? Etc. According to my experience, it is these problems of how the situation should be defined that concern most children and these problems cannot easily be regulated externally.

Multiple Definitions of Situations and the Problem of Intersubjectivity

Through intensive interviewing of children and what I have called dramatic reconstruction (Hundeide, 1978) it is possible to get some indications of how a child has defined the situation he has been through.

One example of this process is provided by Pramling (1983) in her research on preschool children's conceptions of learning and teaching. She interviewed children who had been through a learning sequence in preschool with the intention of learning how to read the clock. For this purpose the preschool teachers introduced cardboard material for cutting and making clocks in order to give them some concrete activities as a basis for their learning.

After a few weeks of this work combined with explanations, the children were interviewed about what they did. The children naturally split into two groups - those who understood that the intention was learning time concepts, and that all the concrete activities of cutting cardboard clocks were means to this end. The other group had no idea of time and the meaning of a clock whatever, and the concrete activities did not in any way change that - for them the intention of the activities, was simply how to cut nice cardboard clocks!

These two groups went through the same experimental procedures viewed from an external point of view. However, they defined or interpreted the situation completely differently, and they also learned different things in the "same" situation. You could probably go on repeating and improving the same learning procedures over and over again and still there would be no improvement in what they learned, until the child's definition of the situation of what is going on was changed.

In a sense one can say that "those who understand the point, are those who are looking for it" (Marton, 1981), and "looking for the point" is a metacognitive

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monitoring or "staging" of the problem within a relevant context or interpretive frame - as judged from the experimenter's perspective. This means that *in any experimental situation there is the problem of convergence of meaning or intersubjectivity between the experimenter and the subject's definition of what is going on, what is the intention, the task in the experimental situation, etc.*

If there is a divergence between definitions, the child's responses will necessarily appear as deviant or incorrect according to a norm based on the experimenter's definition, and there is then the problem of how to interpret such deviant replies - as a *deficiency in the child's operative competence* (Piaget and the psychometric tradition) or as *deficient intersubjectivity between experimenter and child?* (Hundeide, 1978; Rommetveit, 1978; Smedslund, 1977).

If we take the latter point of view, this opens up to the whole field of *diagnostics of the child's interpretive premises* or "positions" - which take for granted that the child responds consistently and plausibly on his own premises in any situation, ("He answers his own questions correctly") and when there is a deviation from adult expectancies, the task is not to judge these according to some external standard, but rather to *uncover the premises from which such replies would appear reasonable and plausible.* (Hundeide, 1985; Keen, 1975; Smedslund, 1977).

Dramatic Reconstruction of What is Going On.

In a series of Piagetian-experiments with young children, I followed this procedure by using a special technique that I called "dramatic reconstruction." After the children had been through the traditional Piagetian-experiment, according to the usual procedure, they were later brought back to the same experimental room by the preschool teacher, and she encouraged them to tell her what had happened during the experiment. The child was first asked to *describe* in detail what had happened, then he was asked to *demonstrate* with the material that was available in front of him, and finally he was encouraged to *role-play* the situation with the preschool teacher in the role of the subject and the child in the role of the experimenter. This procedure gave a lot of information about how the child had interpreted what was going on in the situation and why. All this was video-taped. We soon discovered that despite being exposed to the same experimental procedures, there was a wide spectrum of differences in definitions of what was going on and why, and these differences were directly reflected in the children's replies - *as plausible*

projections or extensions of how they had defined the situation.

Here are a few examples:

A 5-year-old girl called Anni is presented with the number-conservation experiment, where she is first shown a row of five Lego-bricks, then she is asked to make another row with the same number of bricks beneath the first one. When she completes this task successfully she is asked the conservation question whether there is the same number or whether there are more bricks in one or the other. When she answers these questions correctly, the bricks in the lower row are spread out and she is again asked the conservation question. Again Anni confirms through counting that there is the same number, then she arranges all the bricks like this:

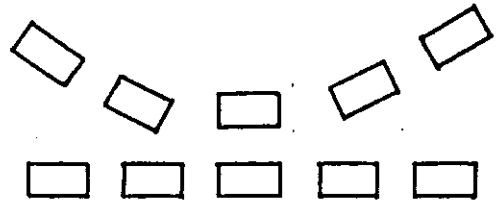


Figure 1: Anni's arrangement of the bricks.

Then she adds: "It is the same number because I can count...it is a baby-snake." This was the first experimental session.

When she comes back to the experimental room with the preschool teacher in order to *reconstruct* what had gone on during the session with "the man" (a student), the preschool teacher first asks: "Can you tell me what happened when you were here with the man? What did you do?" Anni first presents the Lego-bricks as in the initial conservation experiment and says: "Can you count them all?"

Preschool teacher: "1-2-3-4-5, 1-2-3-4-5."

Anni then spreads them out like a snake with both rows of Lego-bricks together in a one-to-one correspondenc and then asks the preschool teacher: "Is this is snake?"

Preschool teacher: "Whether it is a snake?"

Anni: "Yes, it is a snake."

Preschool teacher: "Did the man ask you whether it was a snake?"

Anni: "Yes!"

In this example Anni seems to be moving between two realities, one connected with school-skills, like counting, and the other connected with a pretend and play-world of snakes and fantasy objects. Initially her construction of the brick-snakes is present in parallel with the conservation question, but it is still in the background. During the second "reconstruction session," however, this aspect gains dominance over the conservation questions so that the whole episode is transformed into a fantasy-episode with the experimenter in the role of a co-actor who asks questions about fantasy-snakes.

For this child the play world of fantasy objects is still dominant and in this world conservation questions are not really very interesting and relevant...(Are they ever?) In this case the child reconstructs or transforms the stimulus material into a play world of fantasy objects.

There are also examples in this study of how a question can become "misinterpreted," so that the child is in fact answering another question than the one assumed by the experimenter.

Here is an example of a "false positive," based on a misinterpretation of the question, seen from the experimenter's point of view: In this number conservation experiment we used rectangular bricks like high-rise houses with many windows as elements, instead of Lego-bricks. The child answered correctly all the questions about number conservation, but during the reconstruction, where the child is going to repeat the question that was asked, something else appeared: "He asked me whether the same number of people live in these houses" (pointing to the two rows of bricks).

Preschool teacher: "What did you answer?"

Preschool child: "The same number."

Preschool teacher: "Why?"

Preschool child: "Because they are the same size."

As he was focussing on the number of people in each house (brick), he was not affected by the spreading out of the bricks. He answered correctly, but to another question than the one assumed by the experimenter.

Another child made the same "mistake" but in this case he compared windows in the houses, not people, or number of bricks. The essence of what has been illustrated in these examples, can be represented in the Figure 2. The children described above, are in different "interpretive positions," A, B, and C: As they have different background expectations as to what they are going to do, they define the situation differently (As,

Bs, Cs) and as a consequence they project different plausible solutions a,b,c, corresponding to their situational definitions. (See Hundeide, 1985.)

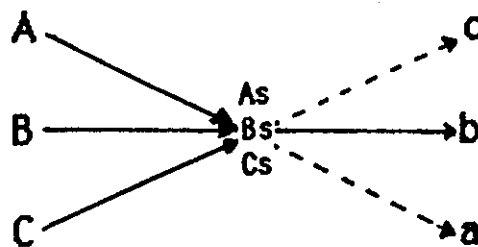


Figure 2: Different interpretive positions.

The interesting point according to this interpretive approach, is not the responses as such and their evaluation according to some external standard, which is the usual way, but rather to see these responses as "documents" or "plausible projections" of premises connected with how the situation, task, etc. is defined. Like a historian interpreting documents from another historical period, not as meaningless deviations from our present standards, but as meaningful manifestations and indications of a different way of life with different customs and world views. *Through a series of such documents and indications it becomes possible in a hermeneutical way to reconstruct a consistent approximation of a life-world that could plausibly produce such manifestations. In a similar way we interpret children's actions as meaningful projections of how they define a situation within their interpretive world.* (Hundeide, 1978; Keen, 1975; Shotter, 1984).

Contractual Congruence and the Social Logic of the Situation: Negotiations and Tacit Contracts About What Should Go on in an Experimental Situation

The child's interpretive world is also an interpersonal world, as Vygotsky (1978) pointed out, which means that our interpretive or cognitive processes have their origin in, and are still part of, *an interactive framework that tacitly directs them in relation to an assumed audience or receiver*: When a child produces an answer in an experimental situation, her reply is not only guided by the nature of the problem as such, but also by the nature of the assumed receiver, and the relationship or "contracts" between the two, as we shall see.

We know that children are easily distracted from their own logical reasoning and conviction by an imposing authoritarian adult who asks guided questions which imply answers contradicting the child's own conviction. An extreme example of this was mentioned to me by a teacher who related the following incident:

A dominating teacher asks Peter the following questions:

Teacher: "Peter, tell me, how many eyes do you have?"

Peter: "Two."

Teacher: "Two?"

Peter: "No - ehe - no - eh - three!"

Teacher: "Three???"

Peter:etc.

Peter is here in a double-bind situation - on the one hand, he has to relate to the external problem as presented by the teacher, which is very easy: How many eyes do you have? On the other hand, he is also faced with the metaproblem of the teacher's disconfirming reaction and of finding out what kind of reply that seems to imply.

This is "the social logic of the situation," and in this case it was obviously stronger than the child's more formal logical conviction. But this is not a special case, in a series of experiments on what I have described as "contractual congruence" versus logical conviction I used the "power of the questions" to demonstrate how most children can easily be distracted from their logical conviction and instead adopt rather bizarre solutions, completely out of tune with their "common sense" and logical reasoning, provided these solutions are in congruence with the social logic of the situation - or the question, in this case.

I used the traditional Piagetian number conservation experiment as an example:

Children were first presented with the tradition number conservation problem within the classical Piagetian framework: A row of five matches is placed in front of the child, and the child is asked to make another row below the first one with the same number of matches. When this is done, the experimenter spreads the matches in the second row, and the classical conservation question is asked: "Tell me, are there more matches here or are there more matches there (pointing) or is it the same number in both rows?"

Most children around 7 years of age, having started school, answer this question correctly. But instead of asking this usual question which implies the tacit

"contract" of all three options, I asked a more closed and guided question which tacitly assumes only one option: Pointing towards the row of matches that was spread out (looking as if there were "more") I asked the following questions: "Tell me, why are there less matches here (spread out), than there?" To my surprise, about 70% of most 9-year-old children accepted the contract of the question, and in spite of their logical competence, most of them gave replies like this: "They are fewer because they are so spread out..." (Hundeide, 1985). In this case contractual congruence was stronger than their logical reasoning - but not for all children, there were children who broke the contract of the question and answered as true Piagetian conservers: "No, they are the same number - if you count them - one, two, three, four, five ..." Still, these were a minority, even at the 9-year age level. (See Hundeide, 1985)

Most children are extremely sensitive to the tacit and very often expressive clues from the experimenter in this type of situation. This applies especially in situations where the experimenter is clearly in control and the child is, so to speak, at the mercy of the experimenter, having to adopt a submissive "pupil role" and answering "fake questions" in order to satisfy the experimenters curiosity or maybe assessment of the child. Both the child and the experimenter know that this not a real question, it is a test-question where the experimenter knows the correct answer and it is asked, not in order to get information about the content of the question, but in order to get information about the child. This is a very different situation from when a friend asks for help about some real problems from his everyday life, and most children know this difference very well, as we shall see.

There is, in other words, a tacit framing of the experimental situation, an unspoken metacontract, which guides the child to adopt a particular attitude and role in relation to the experimenter and this again regulates the direction of the child's awareness, sensibility either towards "contractual congruence" or towards more self-confident logical reasoning. Let us have a look at this difference.

Changing the Metacontract of the Situation

In this experiment which was carried out by Perner, (1984), two different metacontracts for communication were investigated in another classical Piagetian experiment:

The children were asked to pour the same amount of water into a play horse as into a play cow. This was done by first pouring the same amount of water in two identical test tubes, then the water in each tube was

poured into the cow or horse which had different shapes. When this was done, but before the conservation questions were asked, the experimenter was suddenly interrupted and called into another room. A colleague appeared, who obviously did not know anything about what had been going on, and he asked the children to tell him what had happened. In this context of ignorance, asking for information, he casually also introduces the conservation question. For the children, this was a real question for information, not a test question, and when this condition was compared with the traditional Piagetian test situation, there is a significant difference in the children's ability to answer correctly: 81% compared to 47% in the classical situation. (Perner, 1984).

Real questions get real answers, even from children, it seems. The critical issue in this experiment, is not the child's operational competence, but the child's definition of which type of situation he is involved in and which metacontract or interaction rituals are valid in this situation. If this is competence, it is clearly a competence of a different order than the one Piaget is interested in, because *the competence that is required here seems more akin to social dramaturgical skill than operational intelligence* - an ability to assess which type of "scene" it is and "what is going on" in this scene, who are the actors and the roles that are being played and which role is ones own and what is congruent behaviour in that role ... This is a piece of cultural theater from everyday life that we assume most children should master, even in the most alienated experimental situations - describing it as operational intelligence... This is one way of looking at it. (Elbers, 1986).

Dramaturgical and Operative Competence

In a way a child is presented with two problems in such an experimental situation: On the one hand, he has to solve the problem as it is presented - that is, *the direct problem*. On the other hand, in order to give a proper congruent reply within the situational context, he has *the dramaturgical metaproblem* of defining the problem in the context of his definition of the situation, assuming which open or tacit contracts are involved in the relationship between the actors in the experiment, how does this regulate the interaction between them, and in this case, between experimenter and child. If the metacontract for interaction is within the classical teacher-pupil format, the child will be faced with the problem of anticipating the experimenter's intention with the question and the expectations for an appropriate reply: "Why does he ask this question and what kind of answer does he expect?" This is now the social logic of congruence works.

In addition to this, the child will also be faced with the problem of presenting himself in a way that is in congruence with his own self-conception and esteem: If the situation is of great relevance for his self-esteem, the more important will be the problem of self-presentation.

From what has been stated above, there seems to be two dimensions that are involved:

One that is connected with *presenting oneself in a congruent or appropriate manner* in relation to ones' conception of the scene, of what is going on, and to ones' conception of what is the metacontract of the situation, the interaction-ritual with the other actors and to one's position within this interaction...This is the *social-dramaturgical dimension of "staging the problem."*

The other dimension is connected with *finding an operative solution to the problem as presented in relation to external goal-requirements*. If we are dealing with a car that has broken down, getting it started is not *only* a presentational problem, it is also a real problem of mechanics and the goal requirements are quite clear and sharp - either it works and the problem is solved, or it does not work. Both these dimensions are more or less involved in most problem situations.

We can present these two dimensions in a model of cognitive-social problem solving in the following way:

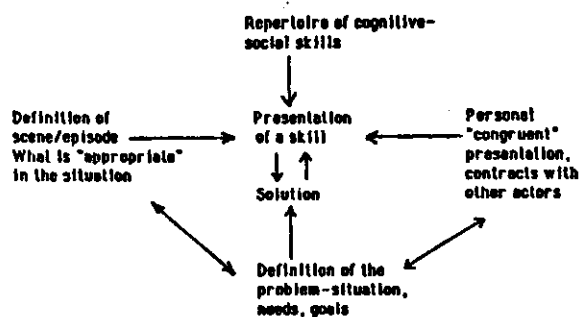


Figure 3: Model of Cognitive-Social Problem-Solving.

There is the *horizontal dimension of social negotiation and congruent presentations* of a reply/solution that is both adjusted to the scene, the metacontract in relation to other actors and to one's concept of oneself within this scene.

As an important corrective to this ceremonial/ritual approach a la Goffman, there is the *vertical dimension of finding an operative solution in accordance with specific goal-requirements*, like a car that has broken down.

How does Piaget's operative intelligence come into this? There are certainly many Piagetian problems that seem to fit more this latter category, but still, there will always be a presentational metaproblem as long as one is operating within an interpersonal scene that has to be defined. Even alone - you are defining the scene and presenting a solution - to yourself, sometimes the strictest judge! It does not seem possible to avoid an assumed evaluative audience with tacit metacontracts that frames your replies, this may be the social nature and origin of cognition, as both Vygotsky (1978) and Mead (1934) believe.

How is it possible to separate the vertical Piagetian "operations" from the horizontal social dramaturgical operations of staging the problem and producing a congruent reply?

This is an impossible diagnostic problem and probably a false one also, because it presupposes a reified conception of mental operations and skills as if they are existing in a vacuum independent and separated from any conception, understanding and knowledge of reality (See Markova, 1982). There has recently been a lot of research pointing in the opposite direction: That our cognitive operations tend to be deeply embedded within the contexts, interpretive frames, scenes, activities and domains (different terminology within different traditions!) where they have had some functional relevance in relation to important projects or goals within the situation. As an example, Lave (1982) showed that Liberian street tailors were not able to transfer their impressive eye-sight estimates of persons' length and width connected with sewing trousers, to an almost identical task of assessing the lengths of sticks. Their operative skill or competence was tied to the specific context and project of sewing trousers! Wason & Johnson-Laird (1972) have demonstrated similar context dependency in connection with abstract deductive tasks! When they are presented within a familiar context and project from everyday life, they become much easier.

What we have called "operative intelligence" within the Piagetian tradition, may, according to this view, be rephrased as a capacity to assess and define the situation in accordance with social conventions that are taken for granted as a basis for intersubjectivity in typical test and experimental situations where such concepts are of relevance, and to behave accordingly, congruently and plausibly. This does not rule out the relevance of

logical operations a la Piaget, the point is that *they function as instruments in relation to social situational goals according to interaction rules for presentation*.

Presentation of Cognitive Skills

The advantage of this dramaturgical and contractual approach to presentation of cognitive skills, is that we avoid the problem of explaining why a child may show concrete operational competence in one situation, but not in another. This is one of Piaget's great problems, the problem of "decalage horizontale" (Piaget, 1950). According to Piaget, if the concrete operational structures are developed in a child, they should ideally appear synchronously in any relevant problem situation that the child is exposed to. Still, there are more variations in this respect than what appears plausible according to Piagetian theory. (Perret-Clermont, 1980)

From the point of view of a presentational theory, on the other hand, this is not a problem, in fact, if we assume that operative "performance" (see Elkind, 1970) is socially regulated, *we would expect variability with regard to when, how and in relation to whom it is appropriate to present that type of skill...* A contractual approach needs to specify these conditions, so that we would get a much more subtle picture of the situational complexities connected with a congruent presentation of a cognitive skill. This is a very important point because it implies a different conception of development as such: Instead of describing cognitive development as a development of purely personal cognitive structures independent of any situation and context, as Piaget does, it would be more plausible from a *contractual point of view to describe development as a process of change in the metacontracts that regulate the definitions or the conditions when cognitive skills should be presented and in relation to whom*. This regulation may again be part of tacit curriculum of socialization with that society (Berger & Luckman, 1967; Leont'ev, 1981).

Mastering Piagetian operations is therefore not enough, according to this perspective: Just as important is it to master the metacontracts, interaction rituals and interpretive frames that regulate when such skill should be presented, and this mastery is a social competence completely infiltrated with the "operations."

This viewpoint has far-reaching implications, also for assessment: Instead of trying to assess in an absolute sense whether a child has reached this or that stage of cognitive development, as is usual within the intelligence tradition (Piaget, 1950), it would be more appropriate, according to a contractual view, to try to describe the conditions that must be present in order for a cognitive skill to "appear," which means when it is

plausible and relevant to present it as a meaningful part of a project and engagement that the child is committed to in this situation. But this leads inevitably into a description of the social reality, "relevance structure" and the life-world of the child, which is a different endeavour from assessing internal cognitive structures. (Hundeide, 1988)

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The Use of Videodisc Interactive Technology for Bilingual Instruction in American Sign Language and English

Vicki L. Hanson
*IBM Research Division
Thomas J. Watson Research Center*

Carol A. Padden
University of California, San Diego

We are concerned here with reporting on a project that uses a bilingual approach to teaching English. In this particular case, the population is elementary-aged hearing-impaired students who are fluent in American Sign Language (ASL), and are in the process of learning English. We use the ASL competence of these children to help them learn more about English. In this respect, the approach bears some resemblance to ideas presented by others with respect to a bilingual/bicultural approach to English instruction for deaf students (e.g., Akamatsu & Armour, 1987; Kannapell, 1974; Schneiderman, 1986; Strong, 1988). Our approach differs, however, in that it makes use of advanced computer technology as the instructional medium.

Schools for deaf children often make extensive use of videotaped materials as an aid to learning. As helpful as these materials often are, they still represent a passive medium for the student. The advent of computer-controllable laser discs, however, allows the instructor to combine the power of video materials with the interactivity afforded by a computer. Our ASL/English program uses interactive video to provide student-directed language learning.

We report here on our initial work on this program. Our conclusions about the students' use of this program are based on observations of students at different points throughout a five month period of operation in an elementary school for deaf children. The students we observed were in third, fourth, fifth, and sixth grades. During that period, both authors worked with the students and with the teachers.

The Approach

Our program is one designed to teach aspects of written English to deaf students who are fluent in

ASL. Two aspects of the preceding statement deserve note: 1) this program focuses on written English, not speech, and 2) the target population is one that has already acquired ASL.

In this project, we use videodisc technology to show students stories signed in ASL. Videodiscs provide for high-density storage of visual and auditory information. A disk can hold 30 minutes of motion video, which translates into 54,000 individual frames of information. Under computer control, selected video segments can be played with random access to any particular frame. An advantage of videodisc over videotape technology is that it avoids the long delays involved in videotape search, with the longest possible delay in a videodisc search being on the order of 3 seconds. Nearly all searches will be less. Any one of the 54,000 frames can be individually "frozen," such that a still picture of that frame is displayed on the monitor. There is currently much interest in interactive video among educators (e.g., Davis, 1988; Nix & Spiro, in press; Seal-Wanner, 1988), including some applications that have already appeared that are directed at hearing-impaired learners (e.g., Brawley & Peterson, 1983; Nugent & Stone, 1982; Prinz, Pemberton, & Nelson, 1985).

The Equipment

The software runs on an IBM Personal Computer, using a monitor that allows video to be overlaid with computer graphics. Thus, both the ASL video and English text can be simultaneously presented on one monitor, with the text appearing on top of the video. The standard computer keyboard is used for student responses. In most cases, students indicate their choice of task by pressing one of the function (F1 - F10) keys on the keyboard. The writing tasks require standard keyboard entry.

In addition, a video disc player is used. A video disc was developed specifically for this project. The disc contains three stories signed in ASL by the second author, a third generation signer of ASL. The videodisc also contains signed feedback for use with the questions component of the program (see below). There is no audio on the disc.

The Computer Program and its Use by Students

The program was designed for student directed learning. It is, therefore, guided by the principle that at any point in time students have various task options, and students select their tasks. There are five main options from which the student can choose:

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- o Watch a Story
- o Read a Story
- o Answer Questions About a Story
- o Write a Story
- o Caption a Story

The student has the additional option of stopping the program. These options are displayed on a menu at the start of the program, and students begin by selecting one of these options. In addition, at every point in the program, students have the choice of returning to this main menu to select a different option or start a different story. After selecting an option from the main menu, students then use another menu to select one of the three stories.

The program was designed to be self-explanatory, so that minimal instruction would be needed to run the program. The primary instruction that students and teachers needed was in how to turn on the equipment since no similar equipment was in place in the school. Teachers were also given a general introduction to the program and an explanation about the five different options. They were told that at all points in time choices about how they could proceed would be displayed on the screen. There was no specific instruction, however, about keyboarding. The students had very little trouble, and most were able to sit down and begin with little or no intervention from us.

We should also note that the program was designed for students in the upper elementary grades. Thus, we assumed some basic reading skills in terms of vocabulary identification for the program options (e.g., "Read a Story"). Familiarity with using computers was not assumed, although all students had some experience through the CAI program already in place at the school. This prior experience with computers minimized the need to give instructions to the students.

The program was effectively used by students working singly or in pairs. More than two students at one time did not allow each child enough time interacting with the computer, and students became bored. Working in pairs was particularly effective in most cases as the students could help each other. They helped each other with vocabulary when reading, and helped each other with all aspects of the writing in the *Write a Story* and *Caption a Story* options.

Watch a Story

With the *Watch a Story* option, students could view one of the three signed stories from beginning to end, or repeat parts of the story or skip ahead in the story. When they selected this option, the signer immediately appeared on the computer screen and started signing the selected story, from the beginning.

When designing this program, we were concerned that the students might become so absorbed in watching the signing that they would want simply to sit and watch the signed stories, without doing the English exercises. This turned out not to be the case. The students were quite intent on interacting with the computer; the more interaction, the better.

Due to this desire to interact with the computer, the *Watch a Story* option turned out to be the least popular option for most of the students. Some of the less able readers did, indeed, simply sit and watch stories, but the other students were not content to do so. This option had been designed so that students could first watch the story, and then do the exercises for that story. While most students initially began here, most exited this option before a signed story was complete and moved on to the other tasks.

Students never, as far as we observed, made use of the possibilities for moving forward in the text or repeating a part of the story. The students may need more familiarity with interactive video to be able to use these choices. In most other cases in this program, student responses are prompted by the computer waiting for them to select the next step. Thus, nothing happens until students respond. In the case of skipping ahead or moving back in the signed story, however, there was something happening. Students were probably unaccustomed to interrupting an ongoing activity on screen.

Read a Story

With the *Read a Story* option, students were able to go back and forth between English and ASL versions of a story. This option was where most students chose to begin after their first time with the program. One concern with programs that require the users to ask for help is whether they will do so when they need it. In this case, the students seemed quite willing to ask for help.

Text was presented one or two sentences at a time, according to how the ASL version of the story was

segmented. The English text captured the meaning of the ASL story, although was not necessarily a close sign-to-word translation.

When the text appeared, students could choose to see the signed version of that story segment or continue to the next text segment. If they chose to see the signed version of the segment, the text disappeared from the screen and was replaced by the signer, signing the corresponding ASL portion of the story. After seeing this signed version of the story, the student then had the choices of returning to the English text, seeing the ASL segment again, or returning to the main menu.

Many of the students tended to sign each of the English words that appeared in the text and then, when they didn't know a word, to ask for the ASL version. Many new vocabulary items were learned this way. After students asked for the ASL version, we then observed them using the sign translation for the English text throughout the remainder of the story. We found that the best readers tended to read to themselves, occasionally pressing the key to see the ASL version of the story when they became unsure about the English text.

This option of the program was appropriate for most students, although we observed that the option was less successful with the least able students. Our analysis was that these students had such poor English skills that they were not able to make the connection between the English and the ASL. Despite the fact that they were told that the English and ASL segments contained the same information, this connection appeared difficult for them to make. Perhaps repeated practice with the program and very simplified English versions of the stories might alleviate this problem.

Answer Questions About a Story

With the *Answer Questions About a Story* option, students were asked questions, in written English, about the signed stories and had to type in their answers. Signed feedback about the correctness of their answers was provided. To be correct, a typed answer needed to contain the precoded word or words.

Probably due to its interactivity, this option was the most popular among the students. The students were receptive to the ASL feedback, and the showing of the ASL segments relevant to the question was very effective. In all cases that we observed, students were able to answer the question correctly after viewing the ASL story segment. We note, however, that only fairly good readers tried this option. Given the fact that

the questions were asked in English, we would expect that students very poor in English skills would not be able to read the questions.

Although the students had the choice of searching the ASL story for the correct answer, they were reluctant to do so. They were more inclined to type in any answer and then get the feedback and the relevant ASL segment shown to them. While an effective strategy from the students' standpoint, this strategy does not help teach them the useful skill of finding an answer for themselves.

Students spontaneously typed sentences as their answers to the questions. Keyboarding skill was not a problem for the students we observed using this option. While the students were relatively slow typists, this fact did not deter them from typing in their sentences.

Write a Story

With the *Write a Story* option, students wrote an English text for an ASL story. When they chose this option, a "paper" appeared on the computer screen for the students to type their story. The size of the "paper" was not limited to one computer screen, but rather could be expanded as needed, to enable students to write stories as long as they wished.

At any point, the student could choose to watch portions of the ASL story. If they chose either of these, their story, to that point, was automatically saved so that they could return to it later. The students' stories were saved in an ASCII file, and the teachers could later print out these stories and correct them, if desired.

Although useful from a pedagogical standpoint, the *Write a Story* option was difficult to use within the constraints of students' keyboarding skills and class schedules. Most students were not interested in writing a long summary of the signed stories. Those students who were interested in doing so were limited by their keyboarding skills. During an allotted computer session, it was difficult to complete more than a few paragraphs. This slowness was due not only to slow typing speeds, but also to students constantly correcting their typing, spelling, and grammar. The students often asked either us or the teachers for help with their vocabulary (i.e., "What is the word for {demonstrate a sign}?") and with their spelling (e.g., "S-O-L-D-I-E-R ?").

Caption a Story

With the *Caption a Story* option, students were able to write an English caption for segments of the signed stories, one segment at a time. The segments could then be played back in sequence to create the effect of captioning the video, thus appearing much like the captioning of a TV show or movie. Thus, this option was essentially the complement of the *Read a Story* option. It could be used as a fun option for students to show their captioning to classmates, friends, and other students.

This option was an advanced option, not appropriate for all students. The primary difficulty was that some instruction was needed in using the program, whereas the other options were mostly self-explanatory.

As this option was introduced late into the program, we have relatively few observations of its use. It appeared, however, to have great potential. It is more fun than the *Write a Story* option, due to the fact that students can overlay their captions on video. This combining of text and video also takes full advantage of the interactive video medium.

As with the *Write a Story* option, students took great care to correct their typographical errors and to work on their spelling and grammar. Given that they were captioning relatively short segments here, this time spent writing was not as detrimental as in the *Write a Story* option. After captioning each segment, students could see their captioned videos, if desired. This instant viewing of their creations was quite rewarding.

Where to From Here?

Our ASL/English program is continuing to be used at the initial test site. Our next step is to provide different levels of text difficulty for the stories. We plan also to incorporate the use of a touch screen in the program so that students will be able to indicate their choices simply by touching the screen. This will not eliminate the need for some keyboarding skills, however, as some will still be required for answering questions, writing stories, and captioning stories. The touch screen does, however, provide easier access to the program for younger students.

We observed from the beginning that a stumbling block in the use of this program was teachers' unfamiliarity with computers, in general. Although some

of the teachers used other computers systems for CAI, they were generally quite unfamiliar with the equipment used here. Despite the fact that our program needs very little instruction to be used, teachers generally were not comfortable with using an unfamiliar computer system in case a problem with the hardware should arise. The most practical remedy for this problem is to have someone on-site who can be used as a resource if a hardware problem should develop.

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