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ABSTRACT

This longitudinal research examines the development of literacy skills in the context of an educational microcomputer implementation conducted to evaluate word processors and LOGO as tools for cognitive enrichment. Three classes including 87 children in Fredericton, New Brunswick, Canada are being followed from first- through third-grade. One class received 5 hours of writing and mathematics enrichment per week and had access to microcomputers with word processing software; a comparison class received the enrichment without computers; and a nonintervention control class received only baseline tests and traditional lessons. At the beginning of the first year of the study, general intellectual functioning, verbal skills, and cognitive style were assessed. Bonitatibus and Flavell's (1985) ambiguity detection task was used as an indicator of metalinguistic performance. Cloze-rated reading comprehension and standardized writing samples were collected periodically. Analysis of data collected during the children's first year in school revealed relationships between ambiguity detection and psychometric subject variables and school performance indicators. Ambiguity detection was related to general intellectual function, certain verbal skills, and cognitive style. A significant relationship was found between ambiguity detection and reading comprehension. Reading, in turn, was related to psycholinguistic measures of writing. Additional analyses suggest the need for further study of the relationship between writing and ambiguity detection. Examples of the texts produced by the children and an analysis of the cloze passage are provided in Appendix A and B, respectively. (RH)

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Some academic correlates of ambiguity detection in primary school children

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Some academic correlates of ambiguity detection in primary school children

This research is part of a longitudinal investigation in which we are following three classes of primary school children from grades one through three. The overall goals of the research are at least threefold. We are seeking to explore the normal development in school of skill in "decontextualized representation" in terms of both literacy (Reid, 1984; Snow, 1983; and Wells, 1985) and mathematics problem-solving development (Papert, 1980). Second, we are developing curriculum enhancement modules for the use of primary school teachers in their efforts to support the growth of their children's formal representations, and third, we are evaluating the usefulness of microcomputer technology, specifically, the use of word processors and the programming language Logo, in facilitating certain language arts and mathematics curriculum goals (Cameron, 1984;1986).

Recent research in the cognitive development of preschool-aged children recounts an impressive repertoire of experiential knowledge, characterized variously, depending on the content and context, as "general event representations" (Nelson, 1978; Nelson & Gruendel, 1981), scripts (Mandler, 1983), and story grammars (Stein & Glenn, 1979; Trabasso, Stein, & Johnson, 1981). These investigations typically involve oral reports of young children. Exploration of the written, and somewhat more decontextualized, and more formal representations of children has concentrated on children in the upper elementary grades (Scardamalia & Bereiter, 1986). This concentration perhaps in part reflects the assumption that there is an extensive discrepancy between what young children can express in print, and what they can report orally, although recent research, such as that of Hidi and Hildyard, 1983, suggests that given an appropriate genre, young children's writing is relatively comparable to their speaking. We have in our expectations followed Donald Graves (1983) in assuming more impressive formal representational skill on the part of the beginning writer than has previously been expected.

Using Hayes and Flower's (1986) model of the writing process as an heuristic, we focus on writing as involving three recursive aspects: planning, sentence generation, and revision. In beginning writing, the focus of the writer seems to be on sentence generation, with planning often "scaffolded" by teacher-generated instructional strategies, and editing requiring skill development subsequent to the activity of getting something down on paper. Numerous writing researchers now speculate on the utility of word processors to enhance the writing process. Bruce & Michaels, 1984; Daiute, 1985; Kane, 1983; Rubin, 1982; and Smith, 1984). Standard word processors seem to provide little structural assistance in the planning process. Considerable support is assumed to be available in the revision process; however, with young writers, this support seems underutilized. In our research, we postulate the utility of a text editor to be in relation to the sentence generation process for the beginning and perhaps motorically undeveloped writer.

Claims are made of a relationship between metacognitive skill and such academic skills as reading (Baker & Brown, 1984), writing (Graves, 1983), and mathematics problem-solving (Papert, 1980), and, more specifically, between the development of metacommunication and the development of skill in writing (Daiute, 1985) with a word processor and problem solving with Logo (Papert, 1980), although the data regarding these latter aussumptions are quite scanty. A relationship is assumed between children's reading and writing, and these processes in turn are expected to relate to metacommunicative skill. Although our reports of this project normally involve outcomes of specific interventions, we decided, for the purpose of this symposium simply to describe the relationships among the linguistic, cognitive, and academic skills of the children tested here with specific reference to the relationships between ambiguity detection, reading, and writing.

Our longitudinal sample includes 87 children enrolled in repesentative first grade classes in Fredericton, N.B., Canada. Fredericton is an academic community, a provincial capital, with the third major 'industry' being a nearby military base. Thus, our sample is largely middle class in home background. Mean socioeconomic score (Blishen and McRoberts, 1976) is 58. At the beginning of the three longitudinal years of formative evaluation, we administered a large battery of experimental and psychometric measures of the children's cognitive and linguistic functioning. The data of interest here were collected during the children's first year in school. Their mean age at time of baseline testing was approximately six years, four months.

We administered Raven's (1984) Coloured Progressive Matrices to all the children along with Peabody Picture Vocabulary Tests (Dunn & Dunn, 1981). Each child was interviewed individually and a self portrait was elicited The interviews were submitted to Miller and Chapman's (1984) Systematic Analysis of Language Transcripts (SALT), and the drawings were scored according to McCarthy's (1972) criteria. The PICAC functions subtest (Porch, 1974) was also employed in order to get a further measure of language productivity. Cognitive style was determined by administration of both the Matching Familiar Figures Test (which we thought might relate more to our language work, Salkind, 1985) and the Children's Embedded Figures Test (which seemed to us to tap the kinds of skills necessary for Logo geometry, Witkin at al, 1971). Further, the children's performance on a task involving communication monitoring (replicating a procedure devised by Bonitatibus & Flavell, 1985) was examined. A measure of ambiguity detection seemed relevant to effective skill in decontextualized representation.

Over the course of the year, samples of the children's writing, reading, and problem solving were collected. Based on pilot work (Cameron, Linton & Hunt, 1985), a sample of the children's script-writing was used to examine writing progress, as children at this age are capable of ready generation of material on such common events, and teacher-generated cloze passages were used to assess reading performance (Bormuth, 1967; Cameron, Linton & Hunt, 1987; Rye, 1982). The script elicited was 'Going to McDonald's', which was subsequently submitted to a SALT analysis. (Appendix A gives examples of the texts produced by the children). The cloze passages were rated in terms of readability to be within three months of the children's grade placement. The task at hand involves silent reading, identifying missing words, and producing them in writing. The cloze passage analyzed here is provided in Appendix B as an example. (Parenthetically, since this research also investigates the use of the programming language Logo as a vehicle in geometric problem solving (Linton, Cameron & Hunt, 1986), a variety of Piagetian measures of geometric knowledge were administered, but these latter will not be reported here, as I wish now to concentrate on the writing of this group of children.)

The three classes of children with whom we work were assigned at random to three different conditions: One class receives five hours of writing and mathematics enrichment work within the classroom by the teacher-member of the research team (AKH). The second class receives comparable instruction with the single major difference being that six microcomputers are available for use in that class. The intervention children in this present study thus participate in these five hours of workshop intervention per week during the entire academic year, whereas the third class is maintained as a control class in which traditional lessons are maintained. There were no mean differences in baseline measurements between the three classes at the commencement of the research.

Our writing workshops are conducted with an emphasis on writing productivity based on the work of Harste, Burke, and Woodward (1981; 1983), Graves (1983). and others interested in a 'whole language', process approach to literacy. Emphasis is placed on the interconnections between reading and writing as constructive processes, and on the importance of linkages with listening and speaking, thus, workshops tend to be somewhat more 'dynamic' than traditional classrooms. Projects involved a wide range of activities across the curriculum: story rewriting (Cameron, Linton, Hunt & Shred, 1985, following Geva & Olson, 1983); scripted dialogues, Cameron, Linton & Hunt, 1986; providing words for a wordless story, and writing persuasive letters, following Berman, 1985, and Kroll, 1984; as well as science observations, social studies reports, and so forth.

Early results of both pilot and first year productivity indicate that although the children who have access to computers typically prefer to use them, neither qualitative nor quantitative differences in productivity is obvious within subjects between machine- and hand-written texts (Cameron, Linton, & Hunt, 1985; 1986). Story rewriting and script writing in pilot work indicated a relationship between reading and writing quality. Further, cognitive style interacted with reading skill in the paired production of scripted dialogues.

As can be seen from the following figures, the children are a normal group, intellectually, with a mean raw score of 18 on the Raven (Figure 1), representing the 50th percentile for children aged 6 years, 9 months to 7 years, 2 months. Likewise, the Peabody IQ's (Figure 2) and McCarthy scores represent an average sample of children. Scores on general level of intellectual functioning relate to eachother and to: the PPVT, and PICAC as language indicators, cognitive style, ambiguity detection, and reading, but only two writing measures (Table 1).

Of the 'oral language measures', which also relate highly to eachother (Table 2), only the Peabody relates to much else. Besides Raven, PPVT performance relates to the PICAC, ambiguity detection and reading. The PICAC relates to little beyond our oral interview, and the interview SALT scores relate to little beyond Matching Familiar Figures (Table 1).

Cognitive style relates to general intellectual functioning, reading, and to one or two writing measures (Table 1).

Ambiguity detection relates to Raven, and PPVT, but most impressively, to reading, and only minimally, to writing. This confirms the oft-reported relationship between reading and metacommunication skill, here, specifically, reading comprehension and ambiguity detection (Table 1). The distribution of scores, however, is bimodal (Figure 3), a point to which I shall return.

Cloze reading comprehension, for its part, relates to virtually everything else including cognitive style, but, most importantly for our purposes, it relates both to ambiguity detection and to writing (Table 1).

Our SALT writing scores which indices intercorrelate highly (Table 3), show the strongest relationships with reading, although there are relationships with intelligence and cognitive style as well. Good readers produce more utterances, more words, and more different words, and, perhaps most interesting, written sentences which more complex in terms of mean length of utterance in both words and morphemes (Table 1).

Concerned that our SALT measures do a better job of reporting the structure, rather than the content of the texts produced, we scored each McDonald's transcript according to its scriptal content, documenting mention of anchor and central events, and the use of temporal order terms, enabling, and temporal links. These scores were analyzed in relation to all our other measures, and revealed significant correlations with the following Salt indices: number of utterances, number of different words, number of words, and MLU in words; showing that such a content approach reveals similar aspects of the children's writing as are obtained from SALT measures.

In order to explore further the possible link between ambiguity detection and writing, and in view of the nature of the distribution of ambiguity detection scores previously mentioned, discriminant analyses were conducted to determine the indices in our battery which reliably differentiate ambiguity detectors. Cloze reading comprehension scores along with PPVT IQ scores reliably discriminate ambiguity detectors when detection scores are dichotomized with a cutoff at six of nine. Second, our early reading test differentiated detectors, and third, several of our writing scores together (number of words, number of utterances, and MLU in words) discriminated ambiguity detectors. These analyses encourage us to pursue further the hypothesized relationship between writing and ambiguity detection.

Further work in this project which holds promise for clarifying these connections involve second grade work currently in progress. First, follow-through work with six classes of first graders is currently in progress. Second, as the leadstream children develop, their writing is advancing beyond simple sentence generation. We are currently piloting a system for evaluating the nature of the children's editorial/revision activities, using a technique based on the Reading Miscue Inventory (RMI) of Goodman and Burke (1972), in which the children's modifications of their own texts are classified as being semantic vs surface, and the like. Along with this, the children have been assessed using the RMI and cloze with the same standard text to amplify our understanding of the reading process. Further, another, somewhat more complex ambiguity detection task is being administered at the second grade level. This longitudinal monitoring is designed to tap the development of the relationships between literacy skills and other cognitive factors, with the expectation that these observations will lead to more rigorous experimental work on the sources of academic variations in performance.

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Michael

McDonald's

I love bigmak Vawe Vawe mac mom And DaD pasz for mi Fud?

John

I oder a hambrger and fihfis and a dreck I had a milk shac and I eat it and I wret hoem The end.

Hari May. 29

I orderd at mc Donald's my mother helped. me to order. I found a table just right. I got pop frinchfris and hambergers. It allwase smels like frinchfris. the frinchfris tast like pgatos.

ERIC Full Text Provided by ERIC

Name: ______________________________

What Can We Make?

Ted said, "Jack has __________ big box.

I have a __________ box, too.

We __________ make something."

"What can __________ make?" asked Jack.

"We can __________ a house!" said Jill.

"__________, we can," said Jack.

Ted said, "My dad __________ some paint in here.

We can __________ the house."

"What colours?" __________ Jill.

"Here's some yellow __________," said Ted.

"Here's some green paint," __________ Jack.

"Here's some orange paint __________ some black paint, too," __________ Ted.

Yellow paint!

Green paint!

Orange __________!

Black paint!

Jack, Jill, and __________ painted the house.

ERIC

	Gnrl Intell Function	Oral Language		Cognitive Style			Reading		Writing					Cameron et. al.	
	McCarthy	PPVT	PICAC	CEFT	MFFT	Ambiguity Detection	Ford/Cameron	Cloze	# Utterances	Errors	# Diff. Words	# Words	TTR	MLU(wrds)	MLU(mrphms)
General Intellectual Function															
Raven	.26*	.27**	.28**	.44**	-.40**	.24*	.41**	.43**						.27*	.27*
McCarthy				.28**	-.43**							.26*	-.23*		
Oral Language															
PPVT			.40**			.46**	.39**	.34**							
PICAC							.23*								
Interview															
# Utterances					.26*			-.22*							
Errors															
# Diff. Words					.22*										
# Words					.23*										
TTR															
MLU-words															
MLU-morphemes															
Cognitive Style															
CEFT					-.43**		.36**	.37**				.23*			
MFFT							-.30**	-.42**			-.30**	-.26*			
Ambiguity Detection							.34**	.40**							
Reading															
Ford/Cameron								.52**			.29**				
Cloze									.22*		.44**	.31**		.26*	.26*

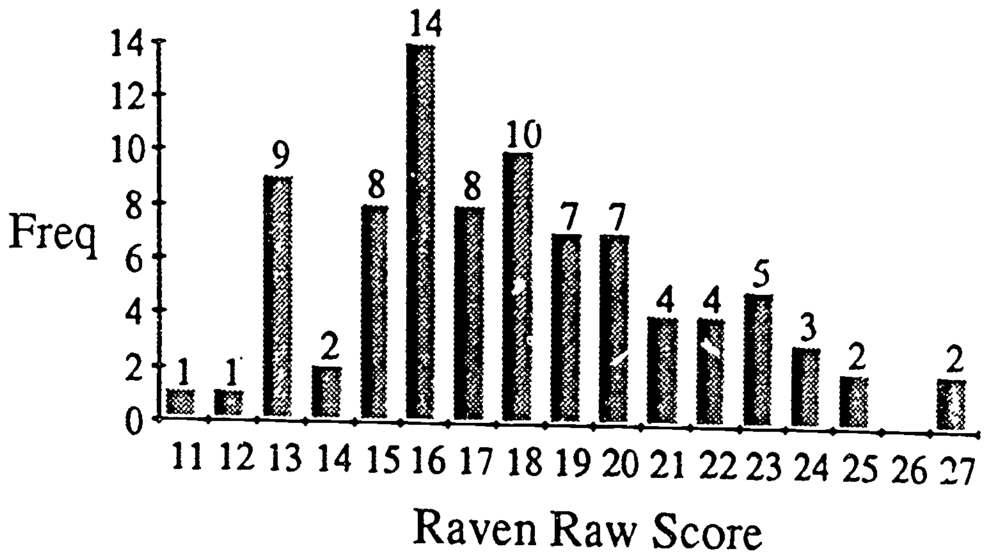
Oral Language

	Picac	# Utterances	# Errors	# Diff. Words	# Words	TTR	MLU-words	MLU-morphemes
$PPVT_{raw}$	.40****							
PICAC			.22*	.34***	.26**		.39****	.39****
# of Utterances			.26**	.92****	.94****	-.47****	.62****	.62****
# Errors				.40****	.38****	-.35***	.56****	.56****
# Diff. Words					.97****	-.55****	.86****	.86****
# Words						-.53****	.80****	.80****
TTR							-.64****	-.64****
MLU-words								1.00****

Writing

	# Spelling errors	# Different words	# Words	TTR	MLU-words	MLU-morphemes
# Utterances		.71****	.72****	-.28**		
# Spelling errors					.24*	.28**
# Different words			.87****	-.29***	.39****	.37***
# Words				-.57****	.46****	.43****
TTR					-.23*	
MLU-words						.99****

General level of intellectual functioning



"Intelligence"

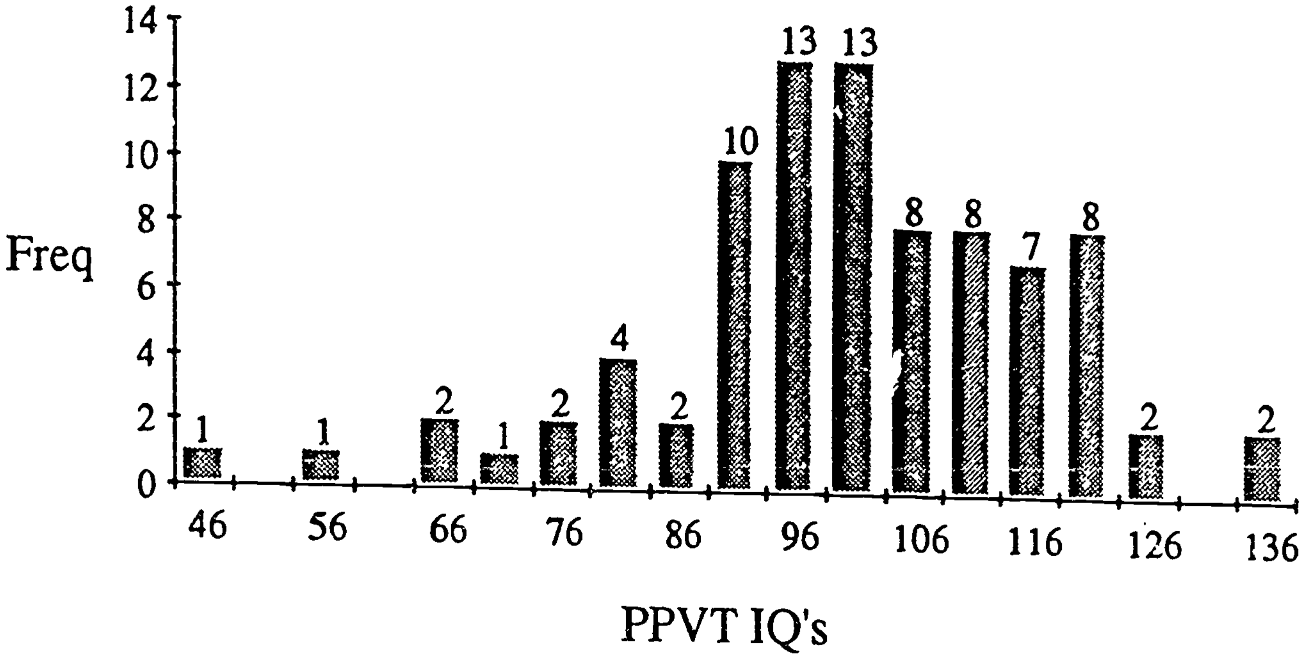
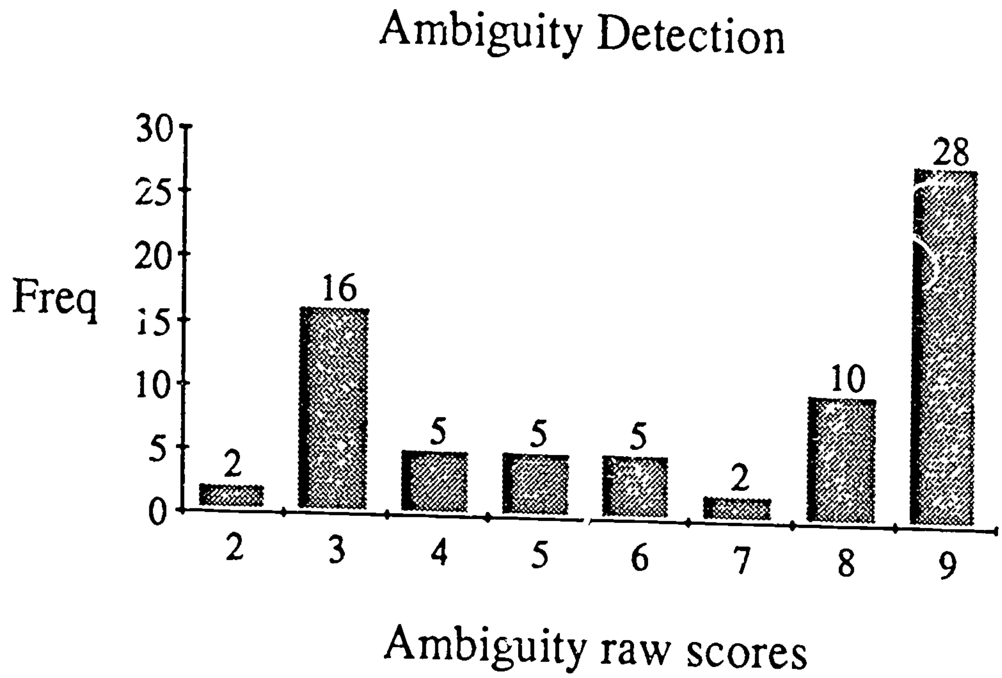


FIGURE 6.



Ambiguity Detection
Freq
30
25
20
15
10
5
0
2
16
5
5
5
2
10
28
2
3
4
5
6
7
8
9
Ambiguity raw scores

Michael

Mc Donald's
I love bigmak Vawe
Vawe mac mom And
DaD pasz for mi Fud?

John

I oder a hambrger and fihfis and a dreck I had a milk shac and I eat it and I whet hoem The end.

ERIC

Hari May.29

I orderd at mc Donald's my mother helped, me to order. I found a table just right. I got pop frinchfris and hambergers. It allwase smels like frinchfris. the frinchfris tast like poatos.

Name: ______________________

What Can We Make?

Ted said, "Jack has __________ big box.

I have a __________ box, too.

We __________ make something."

"What can __________ make?" asked Jack.

"We can __________ a house!" said Jill.

"__________, we can," said Jack.

Ted said, "My dad __________ some paint in here.

We can __________ the house."

"What colours?" __________ Jill.

"Here's some yellow __________," said Ted.

"Here's some green paint," __________ Jack.

"Here's some orange paint __________ some black paint, too," __________ Ted.

Yellow paint!

Green paint!

Orange __________!

Black paint!

Jack, Jill, and __________ painted the house.

General level of intellectual functioning

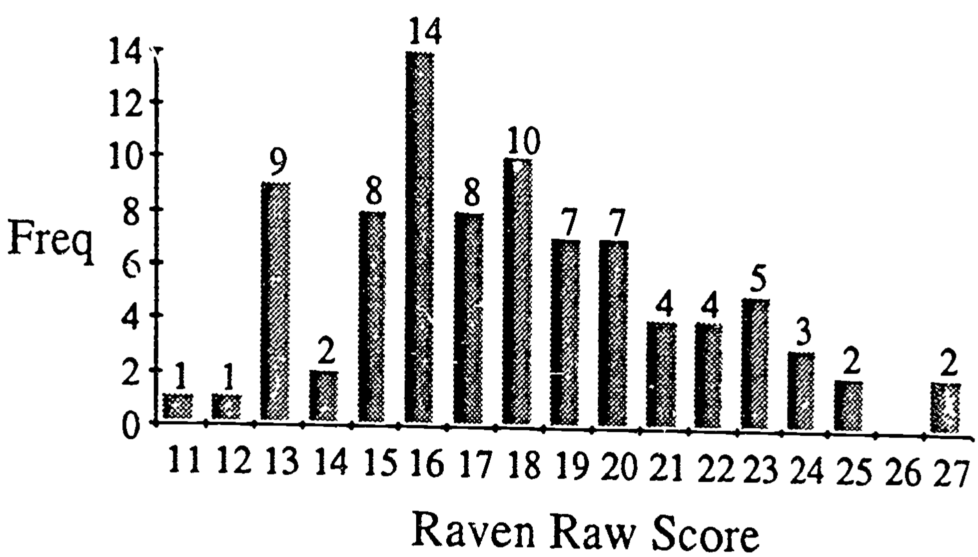


Figure 1

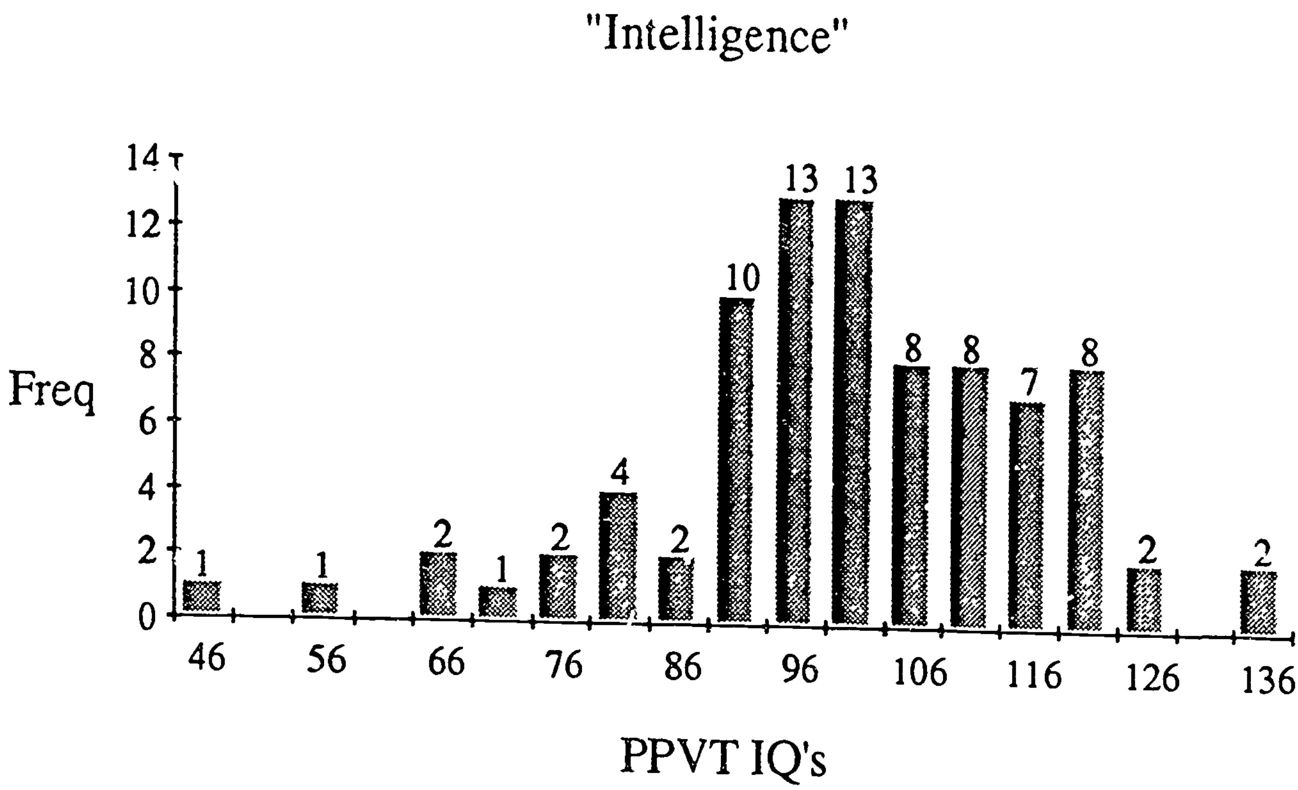
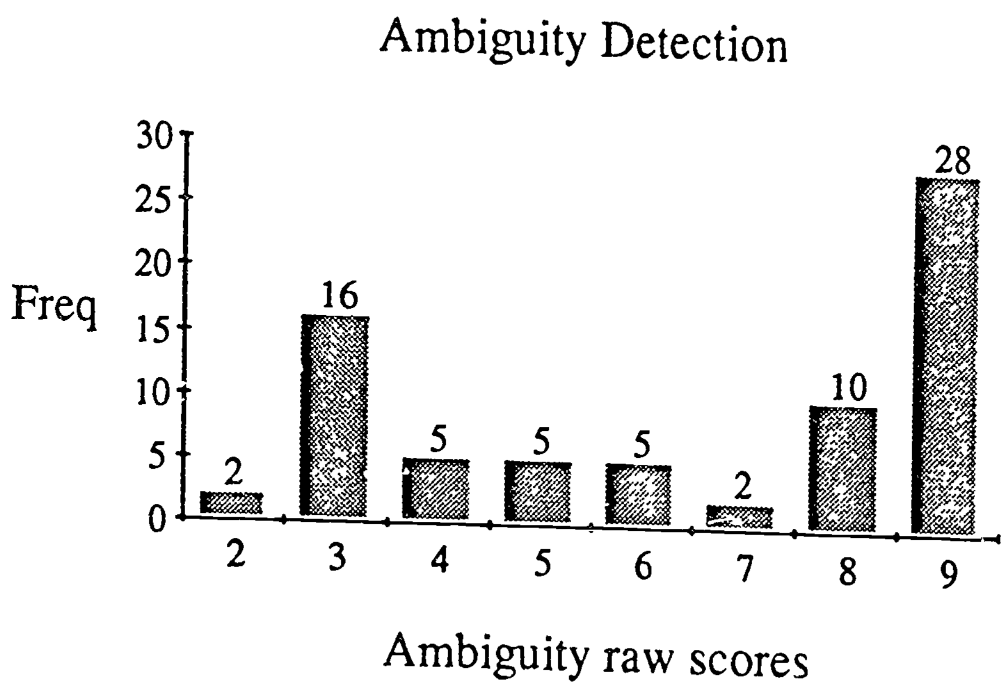


Figure 2

ERIC


Ambiguity Detection
Freq
30
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8
9
Ambiguity raw scores

Figure 3

Table 1

	Gnrl Intell Function: McCarthy	Oral Language: PPVT	Oral Language: PICAC	Cognitive Style: CEFT	Cognitive Style: MFFT	Ambiguity Detection	Reading: Ford/Cameron	Reading: Cloze	Writing (Cameron et. al.): # Utterances	Errors	# Diff. Words	# Words	TTR	MLU(wrds)	MLU(mrphms)
General Intellectual Function															
Raven	.26*	.27**	.28**	.44***	-.40***	.24*	.41***	.43***						.27*	.27*
McCarthy				.28**	-.43***							.26*	-.23*		
Oral Language															
PPVT			.40***			.46***	.39***	.34***							
PICAC							.23*								
Interview															
# Utterances					.26*			-.22*							
Errors															
# Diff. Words					.22*										
# Words					.23*										
TTR															
MLU-words															
MLU-morphemes															
Cognitive Style															
CEFT					-.43***		.36***	.37***				.23*			
MFFT							-.30**	-.42***			-.30**	-.26*			
Ambiguity Detection							.34***	.40***							
Reading															
Ford/Cameron								.52***			.29**				
Cloze									.22*		.44***	.31**		.26*	.26*

Table 2

Oral Language

	Picac	# Utterances	# Errors	# Diff. Words	# Words	TTR	MLU-words	MLU-morphemes
PPVT$_{raw}$	.40****							
PICAC			.22*	.34***	.26**		.39****	.39****
# of Utterances			.26**	.92****	.94****	-.47****	.62****	.62****
# Errors				.40****	.38****	-.35***	.56****	.56****
# Diff. Words					.97****	-.55****	.86****	.86****
# Words						-.53****	.80****	.80****
TTR							-.64****	-.64****
MLU-words								1.00****

Table 3

Writing

	# Spelling errors	# Different words	# Words	TTR	MLU-words	MLU-morphemes
# Utterances		.71****	.72****	-.28**		
# Spelling errors					.24*	.28**
# Different words			.87****	-.29***	.39****	.37***
# Words				-.57****	.46****	.43****
TTR					-.23*	
MLU-words						.99****