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ABSTRACT

High, middle, and low readers in kindergarten, second, and fourth grades participated in a study of inferential comprehension. The Jett-Simpson Classification System for Verbalized Inference was developed, its reliability was established, and children's open responses to a wordless picture book, "Frog Goes to Dinner," were analyzed using it. Results indicated that inferential comprehension was revealed in children's responses during picture-stimulated storytelling; that inference was "interactive constructive" rather than "hierarchical"; that character and plot inference categories were used most frequently at each level; that open-response inference was not dependent upon ability to answer inference questions; and that inference making was not a function of reading level in this study. (Author/AA)

CHILDREN'S INFERENTIAL RESPONSES TO A WORDLESS PICTURE BOOK: DEVELOPMENT AND USE OF A CLASSIFICATION SYSTEM FOR VERBALIZED INFERENCE

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ABSTRACT

There were three specific objectives of this study which was designed to describe inferential comprehension. The first was to determine the feasibility of developing a classification system to describe verbalized inferences; the second was to apply the classification system to observations of the differences in production of inferences by high, middle, and low readers in kindergarten, second, and fourth grades; and the third was to identify the ability of the subjects to answer inference questions about the picture narrative.

The Jett-Simpson Classification System for Verbalized Inference was developed, reliability established, and then the instrument was used to analyze children's open responses to a wordless picture book, Frog Goes to Dinner (Mayer, 1974).

Major findings included the following: (1) inferential comprehension was revealed in children's verbalized response during picture-stimulated storytelling; (2) an "interactive constructive" inference use rather than a hierarchy of inference category use was apparent; (3) main categories of character and plot inference were the most frequently used at each level; (4) open response inference was not dependent upon ability to answer inference questions; (5) inference making in this study was not a function of reading level.

PURPOSE

To provide descriptive information about inferential comprehension was the broad purpose of this study. The specific purposes were threefold: (1) to develop a classification system to describe inferential comprehension of a picture narrative based on natural oral responses of children, (2) to apply the classification system in analysis of the differences in production of inferences by high, middle, and low readers in kindergarten, second, and fourth grades, and (3) to identify the ability of the subjects to answer inference questions about the picture narrative.

BACKGROUND

Numerous studies have been conducted which identify inference as an important component of general comprehension but these studies fail to identify specific characteristics of the inference factor (Davis, 1968; Spearritt, 1972; Pettit and Cockriel, 1974).

Most studies which measured inference used a multiple choice testing format. These questions were based on a list of inference types obtained from inference skills lists in reading manuals, from taxonomies, and from expert opinion. A problem with tests constructed from skills lists in that the contents of the lists are not derived from what children do but rather what adults think a child ought to do. An additional problem is that multiple choice tests have been

found to heavily cue laden syntactically (Bormuth, 1970) and contentively (Pyrczak, 1972; Tuinman, 1974). Also questions of variable syntactical patterns have been found to effect performance (Bormuth, 1970).

This information suggested that a procedure which would allow for an open inferential response in oral language would reduce interference points and provide opportunity to observe natural patterns of inferential comprehension.

Printed material is the common stimulus used to obtain a measure of inferential comprehension. Not only does printed matter confront the child with the challenge of decoding, but the child must also interpret its syntax. In order to obtain a description of inferential comprehension of narrative, it would be useful to develop a measure where decoding print and interpreting syntax cannot be a possible deterrent. It would be desirable to isolate suitable material in a non-print medium.

The narrative is the most common material about which children make inferences in a standard reading program. However, no studies were found which investigated how children at different reading levels used inference within the framework of a narrative.

PROCEDURE

The two major components of the procedure were development of a classification system for verbalized inference and application of the system to a sample of children's oral stories told for a wordless picture book.

Development of the Jett-Simpson Classification System for Verbalized Inference

A preliminary sample of children's verbalized inference responses from high, middle, and low readers at kindergarten, second, and fourth grades was used as a basis for development of the Jett-Simpson Classification System for Verbalized Inference. The sample was examined for inference words, phrases, clauses, and T-units (Hunt, 1965) which were sorted into categories according to common attributes. The majority of sample inferences seemed to cluster around the traditional elements of literature: plot, setting, and character. The classification system which evolved from analysis and sorting is summarized in Figure 1.

The abbreviated description of categories presented in Figure 1 was expanded into a training booklet which included operational definitions, examples, and a flow chart to facilitate use of the system by raters.

Reliability of the classification system was established in three phases. The first and third phases involved submitting three stories to a group of four experts, including this researcher, whose analyses were compared for per cent of agreement. The focus of phase two was refinement and revision of the classification system. The result of the first test

Figure 1. Jett-Simpson Classification System for Verbalized Inferences

CATEGORIES	DESCRIPTIONS
REDUNDANCY	repetitions; non-inferences
DIGRESSION	T-units or fragments not related to story; non-inferences
INACCURATE	incorrect inferences about the pictures
THEME	meaning statements
CONVERSATION	direct statements by the characters
PLOT CATEGORIES	
cause/effect	inferred cause/effect T-units
elaborated event	inferred embellishments of picture facts
added event	totally new event added that fits the context of the picture story
SETTING CATEGORIES	
place/object	inferred name of object or place
refinement	inferred description of environment
time	inferred simultaneous events and/or standard time referents
CHARACTER CATEGORIES	
identification	inferred name or role
refinement	inferred description of physcial qualities or appearance
external behavior	
non-relational external	inferred behavior which is observable but not related to another object or character
relational external	inferred observable behavior related to another object or character
internal behavior	
non-relational affective	inferred internal behaviors of affect not related to another object or character
relational affective	inferred internal behaviors of affect related to another object or character
non-relational cognitive	inferred reasoned behavior not related to another object or character
relational cognitive	inferred behavior related to another object or character

of reliability (phase one), for which there was no direct training, was a mean of 37.84 per cent of agreement. After system revision (phase two), and a training session (phase three), mean per cent agreement was 77.57.

Application of the Jett-Simpson Classification System for Verbalized Inference

Subjects were drawn from a middle class population. There were 21 kindergarteners, 21 second-graders, and 21 fourth-graders classified according to high, middle, and low reading readiness scores in kindergarten (Metropolitan Reading Readiness Test) and high, middle, and low reading scores at second and fourth grade levels (Metropolitan Reading Achievement Test).

Groups of two children participated in a warm-up activity with the researcher which consisted of tape recorder play and oral response to a four picture story sequence developed for the study. When the warm-up procedure was completed, one child returned to the classroom while the other remained to tape record his/her original story for the wordless picture book Frog Goes to Dinner (Mayer, 1974). After the first child finished, he/she returned to the classroom and sent the second child back for storytelling.

In order to obtain additional information about children's abilities to make inferences, each child answered five simple inference questions about the picture book. This procedure allowed for a comparison of a child's natural storytelling with responses made to inference questions.

The taped stories were transcribed then segmented into T-units (Hunt, 1965) for analysis using the Jett-Simpson Classification System for Verbalized Inference. Verbalized inferences were defined as those oral statements or words expressed by the child which demonstrated thinking and imagination that went beyond the specific concrete picture facts.

RESULTS AND DISCUSSION

Results for main categories and subcategories of the classification system as well as responses to questions will be presented first followed by brief discussion.

Main Categories

The Friedman two-way analysis of variance (Siegel, 1956, p. 166), summarized in Table 1, indicated significant differences, $p < .001$, in quanitity of inferences between grade levels for all main categories except theme. Verbalized inferences increased as grade level increased for conversation, plot, setting, and character. This was accompanied by increase by grade level in number of T-units and ratio of inferences to T-unit. For the categories of digression and inaccurate inferences, the reverse was the case except for low readers, whose inaccuracies increased from kindergarten through the fourth grade.

The appearance of responses in all main categories, except theme, may have been dictated by the strength of the unity of literary elements within the picture story. Those elements, though isolated for study purposes in this study and by literature experts, have been found to behave in an interactive manner. An act cannot be separated from the person who commits it.

Table 1. Summary Table of Differences Between Grade Levels for Main Categories

Category	Degrees of Freedom	χr^2
Digression	2	24*
Inaccurate	2	20.3*
Theme	2	00.0
Conversation	2	23.1*
Plot	2	24*
Setting	2	23.1*
Character	2	24*

*χr^2 13.82 = $p < .001$

Thus, plot cannot be discussed without character since the significance of plot is revealed in character. The theme is the meaning of the actions of character, and setting provides the arena for that action.

That direct statements of theme do not appear in the natural storytelling responses of the children. supports Cullinan's (1971) contention that children seldom make theme statement's independent of teacher guidance.

One possible explanation for the increase in inference across grade levels could be that it is a function of the well documented fact that volume and complexity of language increase with age for the elementary child (Hunt, 1965; O'Donnell et al., 1967). The availability of more complex syntactic structures in the child's language repertoire would allow for a greater variety of ways to express relationships among characters and event's which in turn would provide the linguistic structure for more inferences.

The fact that older children produced longer stories suggests that they were collecting more total information and inferences from the picture story stimulus. The stories of the kindergarten children, on the other hand, were shorter and reflected less attention to total picture information.

The decrease in digression and inaccuracy across grade levels suggests that, as age increases, the child is more able to center attention on the story and accurately determine inferences.

Why low readers increased in number of inaccurate inferences between grade levels is not clear from this study.

The Kruskal-Wallis one-way analysis of variance for ranks (Siegel, 1956, p. 184) was used to determine the differences for reading levels within grade levels for main categories and is summarized in Table 2. The results were only significant for kindergarten conversation ($p < .02$). Individuals who made the most and least inferences in all other categories were distributed among the three reading levels. The verbalized inference variable did not discriminate among high, middle, and low readers within grade levels. The Kruskal-Wallis statistic was not applied to the categories of digression and inaccuracy because the scores for these were too small and there were too many ties in the ranking. That there were no differences among the reading levels for each grade level suggests that the inference-making phenomena observed was more a function of age than reading ability.

Table 2. Summary Table of Differences Within Grade Levels for Main Categories

Category	Grade Level K	2	4
Conversation	7.8*	5.7	1.0
Plot	1.8	1.15	-6.14
Setting	-2.7	1.93	4.15
Character	.86	.81	3.70

2 degrees of freedom *H 5.99 = p .05

Frequency of occurrence of main categories, reported in Table 3, had the same ranking at second as at fourth grade level; kindergarteners differed only in the juxtaposition of rankings on inaccurate responses and conversation. At each level, character inferences predominated, followed by plot, and then setting inferences. Literary elements had about equal influence over subjects from each grade level.

Since the only constraint on the child's choice of inference was the picture story itself, the order of frequency of responses for categories suggests that certain literary elements are more important to the storyteller. Character was clearly the area of major interest, followed by plot. Brooks and Warren (1960) point out that plot and character are inextricably interwoven. The events of the story involve the actions of the characters and the character's actions are the events of the story. Children have responded to this unification by using plot and character as their dominant responses.

Table 3. Percentages of Inference Within Grade Levels: Main Categories and Subcategories

Categories	Grade Levels					
	K % of Resp.		2 % of Resp.		4 % of Resp.	
	Main	Sub.	Main	Sub.	Main	Sub.
DIGRESSION	3.95		.44		1.00	
INACCURATE	7.71		2.44		1.93	
CONVERSATION	5.53		10.41		10.56	
THEME	.00		.00		.00	
PLOT	22.33		21.26		21.34	
cause/effect		2		3		3
elaborated event		21		19		20
added event		4		3		12
SETTING	10.47		13.51		15.02	
place/object		10		8		7
refinement		3		4		5
time		.2		4		4
CHARACTER	50.00		51.94		51.15	
identification		5		10		12
refinement		6		9		17
non-relational external		4		4		3
relational external		24		21		15
non-relational affective		9		7		4
relational affective		3		2		4
non-relational cognitive		2		2		.4
relational cognitive		6		4		3
	100%	100%	100%	100%	100%	100%

Subcategories

Results for the differences between grade levels for the subcategories of plot, setting, and character were similar to the pattern identified for main categories: subjects made a greater number of responses in a subcategory as grade level increased. The grestest increase was for time inferences. They were nearly non-exixtent at kindergarten, one response, but sixty-two responses were present in the fourth grade sample. Two exceptions to the increase pattern were the subcategories non-relational cognitive and relational cognitive for which second grade subjects made the greatest number of responses.

It was expected that responses for subcategories would suggest a pattern of hierarchy: that certain kinds of subcategory inferences would not appear at the kindergarten level and others would decrease significantly at the fourth grade level. Time was the only subcategory that suggested a hierarchy. Rather than responding differently to the remaining subcategories, the children responded similarly in terms of proportion of total response. Even the low readers who made more inaccuracies responded holistically to the stimulus. The children appeared to take a global approach to inference making in relationship to the picture narrative.

Percentages of inference within grade levels for subcategories showed that the highest frequencies for kindergarten, in accending order were relational external and elaborated event; for second graders, relational external, elaborated event, and character identification; and for fourth graders, elaborated

event, character refinement, relational external, and character identification. See Table 3. The relational action of characters dominated the responses of kindergarteners and second graders but for fourth graders the attention appeared to shift somewhat to plot and physical appearance of characters.

The action of the characters in the story Frog Goes to Dinner (Mayer, 1974) obviously had strong appeal. Since character action plays a dominant role in the development of the plot for this story, it follows that the responses were also, to a degree, a function of the stimulus. The picture story placed little emphasis on the cognitive. However, every illustration expressed strong feelings of character through facial expressions. Cognitive inferences were perhaps less obvious to the child than relational external inferences.

Responses to Inference Questions

Number of correct responses to the inference questions asked following the storytelling increased between grade levels for all reading levels. Kindergarten children made more incorrect than correct responses. The situation was reversed for second and fourth grade children. The scores were a perfect rank ordering for the expected value of the Friedman two-way analysis of variance (Siegel, 1958, p.166) so the differences between grade levels were significant at $p < .001$. See Table 4.

There are several possible explanations for this occurrence. First, since the older children made more total inferences, they were probably obtaining more information about the entire story than the younger children which would give them a broader information base for answering questions. Second, the higher

rate of digression and inaccuracy for kindergarten children may have interfered with the apprehension of the relationships in the story and thus ability to answer relationship questions. Third, it may be that the syntax of the questions interfered with the child's comprehension of the questions. Bormuth (1970) has shown this to be an observable phenomenon.

Table 4. Percentage of Correct and Incorrect Responses to Questions for Reading Levels

	Grade Levels					
	K		2		4	
Reading Level	% Correct	% Incorrect	% Correct	% Incorrect	% Correct	% Incorrect
High	35	65	63	27	91	9
Middle	35	65	71	29	86	14
Low	20	80	69	31	80	20

LIMITATIONS

The results should be interpreted in light of the following limitations:

1. Verbalized inference was investigated for only three age groups: kindergarten, second, and fourth grades. These groups were selected for the study for two reasons: (a) it was thought that by selecting every other grade level, differences would be more pronounced, (b) kindergarten children are typically entering the stage of concrete operations and fourth graders are entering the stage of formal operations (Piaget, 1970).

2. The sample for this study was drawn from a middle class school population. No attempt was made to examine other

socio-economic groups, since it was the interest of this researcher to observe developmental trends only among one population type.

3. The researcher was limited by school district decision to the student population of a single school.

4. The operational definitions used in this study, although carefully selected on the basis of theory and research, determined the concept of inferential comprehension and influenced the development of the observed categories of inference.

5. Only inferences overtly visible in the oral language of the subjects were analyzed. There may be other paralingual sources of inference.

SUMMARY OF CONCLUSIONS

Tempered by the limitations of the study, the following conclusions appear to be warranted by the data collected.

1. Inferential comprehension is revealed in children's verbalized response during picture-stimulated storytelling.

2. As age increases so do number of inferences.

3. Inference making in this study was not a function of reading level.

4. For low readers there was a trend for inaccuracy to increase with age.

5. Character and plot are the dominant inference categories.

6. Dominant inferential response patterns may be a function of the unity of literary elements, child choice in selection of picture information, cognition, and the stimulus material.

7. Reslults support a holistic interactive constructive view of inferential comprehension rather than a hierarchy.

8. Open response inference is not dependent upon ability to answer inference questions.

IMPLICATIONS

Educational Implications

The foregoing conclusions suggest several implications for educational practice.

A Paradigm for Inferential Comprehension: Skills Hierarchy? Holistic? Patterns of response suggesting an inference hierarchy were not observed. There may have been unobserved qualitative differences in all the responses of younger and older children however, all children did respond in the areas identified. This suggests a holistic response to the picture narrative. In view of this behavior, perhaps educators should reconsider the excessive current efforts to fragment comprehension into many discrete parts. In addition, perhaps the widely accepted practice of directed reading should be tempered to include more opportunities for the child to read the story as an uninterrrupted whole and respond to the story with holistic activities.

Techniques for Eliciting Inferential Comprehension: Questions? Constructive-Interactive Activities? The implications related to this issue revolve around claims made by numerous classroom teachers that young children and low readers cannot make inferences. Both groups made inferences in this study and made them in the same categories as high and middle readers.

However, the kindergarten children had difficulty answering inference questions as did the low readers. Excessive questioning may interfere with inferential comprehension at least for the young and low reader. This suggests that activities which are constructive, such as the storytelling activity in this study, could allow expression of inference and perhaps facilitate its development. Constructive activities involve the child actively and directly in the story itself. Role playing activities, creative drama, and puppetry are other interactive constructive activities.

Constructive activities have an additional advantage over questions because the construction process and active involvement ground the inferences to concreteness. It may be that children's ability to answer inference questions could be facilitated by using the more concrete activities listed above as a foundation.

Inferential Comprehension: Comprehension Skills Lists? Literary Elements? Since there was a natural clustering around the traditional elements of literature in the stories, it might be useful to structure questions and discussions around these features as opposed to long lists of comprehension skills. The understanding that each part of the story links with the next part was demonstrated in almost all stories. However, not all children could talk about the holistic nature of the story outside of the telling. The interlocking nature of the literary elements suggest that by guiding the child to discover how a story works as a whole, the child's general and inferential comprehension would be facilitated.

Initially activities, questions, and discussion could focus on character since it captured the main interest of the children. The focus of the character activities could be first on R-external behaviors and then the two internal behaviors, affective and cognitive. This sequence could allow the children to use the concrete information obtained from external behaviors as indicators of internal processes.

Inferential Comprehension: Wordless Picture Books as a Stimulus? The wordless picture book used as stimulus material here was successful in eliciting inferences. Such books could be used in the classroom to develop inference ability. It might be that learning to make inferences with non-print media would aid inferential comprehension of printed material. Wordless picture books could also be used in the classroom to further develop a child's sensitivity to literary elements.

Research Implications

One primary objective of this study was to obtain descriptive information which would suggest directions for experimental and further descriptive research. Some directions for research suggested by the data in this study are briefly described below.

1. The classification system could be applied to a wide population to determine if the same events occur.

2. An experimental study could be conducted where wordless picture books and storytelling are used as training materials and procedures for developing inferential comprehension.

3. Students could be trained to make inferences for wordless picture books and tested to determine whether their

ability to make verbalized inferences can transfer to making inferences about printed material.

4. Questions could be developed for a story or picture which are concrete inference and relational inference to determine if there are differences in ability to answer the two types.

5. Two different types of wordless picture books could be presented to children to determine the influence of the stimulus on the responses. For example, Frog Goes to Dinner (Mayer, 1974) contained much character action. Responses to it could be compared to responses to a book where the "action" of the characters provides major opportunities for making inferences about feelings to determine if the dominant character inference remains relational external.

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