An Information Processing Analysis of the Interpretation of Proverbs by Grade Nine Students: An Exploratory Study

by

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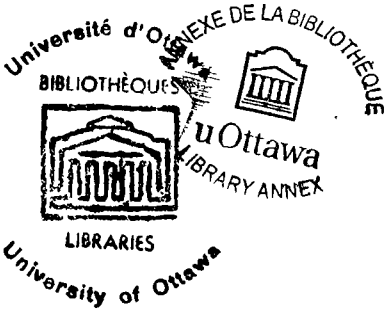

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ABSTRACT

Honeck, Voegtle, Dorfmueller, and Hoffman (1980) proposed a sophisticated four phase model to explain the interpretive process involved in the comprehension of proverbs. The primary objective of this study was to conceptually extend this model by developing a methodology that could be used to identify elementary information processing components involved in the third or Figurative Phase.

The following four research questions were addressed: (1) What are the information processing components used by grade nine students during the figurative interpretation of a proverb? (2) Is the negotiation of the four phase sequence proposed in the Conceptual Base Theory a prerequisite for the correct interpretation of a proverb? (3) Is there an association between the observed information processing patterns demonstrated by the grade nine students and the independent variables of gender and verbal reasoning ability? and (4) Is the construction of a four-term analogy a necessary and sufficient condition for the correct interpretation of a proverb?

The sample consisted of 40 males and 40 females who were enrolled in the ninth grade at a local high school. Four balanced groups reflected the variables of gender and verbal reasoning. The students were given three proverb sets and each set contained one proverb, two abstract sentences, and six concrete sentences that were more or less related to the proverb's figurative meaning. Each student was asked to think aloud while he/she ranked each sentence in a proverb set according to how well each sentence illustrated the figurative meaning of the proverb.

The verbal protocols generated by the students were analyzed using the classification scheme developed in this study. Four episode types (Encoding,

Analyzing, Monitoring, and Response Category) were identified which provided information about the global process involved in the interpretation of proverbs. The identification of information processing components provided information about the processes involved in the interpretation of proverbs at a more refined level. Of particular interest were the components comprising the Analyzing episode: Analogy Construction, Key Word, Element Comparison, Conceptual Figurative, Forced Match, Surface Processing and Personalizes Elements. Significant differences in performance were found between the verbal reasoning groups but no such differences were found between males and females. Analogy was observed to function as a structural paradigm as well as a process. It was concluded that the Conceptual Base Theory provides a useful representation of the interpretive process.

The implications of the results of this study for educators is discussed and suggestions for further research are offered.

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Chapter 1

INTRODUCTION AND RESEARCH OBJECTIVES

The prevalence of figurative language in a student's environment makes research focusing on the ability to produce, interpret, and comprehend figurative material of considerable educational interest. While much has been written about the production and comprehension of figurative language, there is a dearth of research that focuses on the interpretive process itself. Consequently, there is little information available to the educator interested in understanding how a student constructs a meaningful figurative interpretation. The following discussion centres on two general limitations common in much of the research in figurative language.

The first limitation concerns the conceptual framework and methodology commonly employed in much of the figurative language research. Usually, students' figurative understanding is measured by comparing a student's performance outcomes (in terms of production and/or comprehension scores) on time-limited tests with group norms. In many cases, the only variables of interest are the quantity of figurative language produced, the number of correct solutions, and the average time to solution. However, measures such as the quantity produced, the correctness of a response or the time needed to achieve it, though useful for other purposes, do not describe how a student constructs a meaningful figurative interpretation from a meaningful literal interpretation and they do not identify why some students have difficulty understanding certain figurative expressions. While group norms provide a standardized method for classifying students according to constructs such as their verbal ability, the group norms do not provide a description of the cognitive processes that underlie a student's

performance nor do they allow for the identification of information processing components. In short, while quantitative data may provide operational measures of how much one can produce and/or comprehend a given figurative expression or form, they reveal little information about the interpretive process. Since it is reasonable to predict that learning is restricted if a student cannot interpret figurative language and that learning is restricted if a student cannot understand that language is not limited to what might be called strictly literal uses, it is important for the educator to be cognizant of the interpretive process in terms of the sequence of cognitive events involved in moving from a literal level of meaning to a figurative level of meaning.

If educators are to understand the interpretive processes involved in figurative language, they need a clear picture of the information a student extracts from a figurative expression, the representation of that information, and the cognitive processes that are applied to the representation. Consequently, an approach is needed that focuses on how students process information from the time they are presented with figurative material until they construct a figurative meaning. Information processing represents such an approach. The information processing approach allows the interpretive process to be analyzed and decomposed into a number of components. Thus, one of the goals of the information processing approach is to identify the components of the interpretive process to identify the sources of individual differences. This is generally accepted to be an approach that has been neglected in figurative language and educational research.

However, once the potential of a process-oriented approach is recognized the problem of observing covert cognitive processes still remains. Asking students to think aloud while they work at a task is one methodology that encourages students to generate sequentially-linked, observable data in the form of verbal protocols. Such a methodology permits the identification of information processing components and

patterns used by students. Thus, if a student is unable to construct an interpretation of a figurative expression, or if the interpretation is incorrect, componential analysis of a student's verbal protocols may reveal if the difficulty exists in the components of information processing or in the strategies used to combine them. Such additional knowledge is bound to contribute to our knowledge of the learning process and by extension to the fields of educational planning and instruction. For example, a student's information processing profile could form the basis for intervention designed to ameliorate a student's figurative competence.

The second limitation concerns the figurative material commonly employed in figurative language research. This limitation appears to have its roots in a restricted definition of the term figurative.

Much of the research focuses on metaphors almost to the exclusion of other figurative forms. This preoccupation with metaphors is understandable considering how often the terms metaphoric and figurative are used interchangeably. This not only creates confusion but leads to the assumption that the terms are synonymous; however, these terms should not be used indiscriminately since metaphoric language is only one form of figurative language. Within this context, metaphoric language is always figurative but figurative language is not necessarily metaphoric. Indeed a reflection of this problem is the need for research that incorporates other forms of figurative language.

Proverbs represent a particularly interesting category of figurative material for educational research because of the insights they can offer into two interrelated areas important for academic success - language and cognition. For example, the proverb: Run after two hares and you will catch neither has both a literal and a figurative level of meaning. At the literal level, the proverb gives advice about catching hares, whereas at the figurative level it suggests that if you try to do too many things at once you may accomplish none of them.

The figurative meaning is not directly specified by the proverb; rather, an individual must figure it out using a variety of cognitive processes. If the individual constructs a good theory of the underlying message, he/she not only understands the sentence at a figurative level, but, in addition, becomes able to recognize novel sentences expressing a similar message. Thus, the ability to interpret proverbs and to construct a figurative meaning from a literal referent represents a synthesis of complex linguistic and cognitive skills.

The Conceptual Base Theory (Honeck, Voegtle, Dorfmueller, & Hoffman, 1980) provides a global characterization of the interpretive process. Honeck et al. (1980) describe proverb comprehension in terms of a four phase sequence of cognitive processes that results in an abstract, generative base that serves to relate events that are dissimilar on a literal level. An integral feature of the Conceptual Base Theory is the use of an analogy format as a model of the comparison process between dissimilar, literal elements.

The present study differs in a number of respects from traditional studies frequently encountered in the research literature concerning figurative language. First, the study is process oriented, that is, it regards the components of the process as sequential units leading to the construction of a meaningful figurative interpretation. It is expected that this approach will avoid the general restrictions inherent in traditional measures of figurative competence which have neglected such questions as "What types of cognitive processes operate during the construction of a figurative interpretation?" or "Can one identify the information processing components which might be responsible for observed differences in performance?" This approach represents an important shift that has occured in educational research. This shift has been towards a concern with the content and structure of cognitive processes underlying performance rather than the performance per se, that is, the outcomes of performance.

Second, the figurative material used in the study involves proverbs rather than metaphors. To this end, an operational definition of proverb is stated to distinguish proverbs from metaphors. The construction of a correct, figurative interpretation to a proverb represents a complex linguistic and cognitive problem solving activity that requires an ability to translate concrete symbols into generalized, abstract concepts or categories. Considering the various reading and instructional material students encounter, a high level of interpretive and inferential skill is a prerequisite for learning. The study does not necessarily concern itself with a student's ability to comprehend proverbs but, rather, it uses proverbs as a tool to describe those information processing components involved in the construction of a figurative meaning.

Third, data for the study are derived from verbal protocols. Traditionally, verbal protocols are obtained through interviews; however, the verbal protocols in this study were obtained by asking students to overtly verbalize their thought processes, and to think aloud while working at a task. The recorded verbalizations were transcribed and then analyzed according to content analysis techniques to develop a classification scheme to represent sequences of component processes. The verbal protocols were used to derive both qualitative and quantitative information.

Finally, the findings of the study are expected to contribute to educational knowledge by providing systematic descriptions of the component processes involved in the construction of a meaningful figurative interpretation. Such descriptions should help identify sources of success as well as difficulty in comprehending figurative language. It is conjectured that a focus on processes will reveal information complementary to what can be captured by traditional, product oriented approaches.

The principal concern of this study was to develop a methodology that can be used to identify and describe the information processing components involved in the construction of a meaningful figurative interpretation of proverbs. It is expected that

the development of such a methodology will reveal how proverbs are processed and understood. The study was not concerned with tracing cognitive development nor describing differences in cognition related to age. It was exploratory and process oriented. It was a study in problem solving albeit linguistic problem solving.

Broadly, the objectives of the study can be stated as follows:

1. to identify and describe the information processing components employed by grade nine students during the interpretation of proverbs;

2. to investigate the appropriateness of the interpretive process proposed in the Conceptual Base Theory;

3. to investigate the degree of association between the observed information processing patterns and the variables of gender and verbal reasoning ability; and

4. to investigate the role of analogy during the interpretation of proverbs.

Limitations of the Study

The present study was exploratory in nature with the results presented as initial empirically derived information about the cognitive processes employed by grade nine students during the interpretation of proverbs. The following limitations are presented to provide the reader with a contextual framework and, implicitly, to suggest areas requiring further research.

The generalizability of any findings of the study is limited due to the size of the sample and the figurative material. Such difficulties seem inherent in figurative language research and are well documented (Honeck, 1986).

Certain limitations have resulted from the use of the "think aloud" methodology and protocol analysis as sources of data about the interpretive process. While the

students' verbal protocols provided a rich source of data, the contents of the protocols were restricted to what the students were able to verbalize during the task. Consequently, the protocols are reliable for what they contain but not for what they omit.

The results of this exploratory study are to be interpreted as tentative until they can be replicated using other samples, tasks, and figurative material. Nonetheless, the study raises issues and questions that provide an initial step to further research. A major objective that emerged during the study was the development of a classification scheme that could be used to identify and describe at least some of the information processing components involved in the interpretation of proverbs. In this regard, the findings of the study were encouraging. The results of this study were compared with those of other studies of figurative language as well as proverb comprehension and areas of considerable agreement were identified. Therefore, despite its limitations the study represents a useful contribution to the conceptualization and design of future research investigating the cognitive processes involved in the interpretation of proverbs and other forms of figurative language.

Chapter 1, INTRODUCTION, contains the orientation to the study which includes the rationale as well as the broad research objectives. In Chapter 2, REVIEW OF THE LITERATURE AND CONCEPTUAL FRAMEWORK, the research objectives are brought into focus on the basis of a discussion of a selected review of the research literature relating to education and figurative language in general and proverb comprehension in particular. The discussion of the implication of previous proverb research provides the background to the conceptual framework used to develop the problem statement and research questions for this study. In Chapter 3, RESEARCH METHODOLOGY, the operational details of the study are presented and the methodology used to analyze the cognitive processes involved in the interpretation of

proverbs is described. In Chapter 4, PRESENTATION AND INTERPRETATION OF THE RESULTS, the results of the study are presented and discussed while Chapter 5, CONCLUSIONS, is a discussion of the results with a particular emphasis on their implications for education. The implications of conceptual and methodological aspects of the study are also discussed.

Chapter 2

REVIEW OF THE LITERATURE AND CONCEPTUAL FRAMEWORK

This chapter is a review of the literature of various aspects of figurative language in general and proverbs in particular. The first section is a discussion of the prevalence and function of figurative language in education while in the second section the operational definition of proverb used in this investigation is presented. The third section is a selected review of the proverb research which provides the foundation for the development of the conceptual framework of this study. The conceptual framework is presented in the fourth section followed by the statement of the problem and the research questions.

Education and Figurative Language

In education, the usefulness of figurative language in classroom practice has been given slow recognition even though students' confrontation with figurative language is assured because of its prevalence in educational texts and spoken language. Honeck and Hoffman (1980) stated that "...it is a euphemism to say that there is a deficiency in the way our educational system treats the understanding of figurative language". (p. 16). Furthermore, it is acknowledged by certain educators that learning the correct interpretation and appropriate use of figurative language is important to adolescents in both their academic and personal-social development. For example, understanding figurative references in such domains as Science, Mathematics, and English contributes to school achievement while knowing the current slang of a peer group is often critical

to social acceptance (Nippold, 1985). Although some educators espouse the traditional Aristotelian view that figurative language is ornamental language, others have identified its educational potential to facilitate the acquisition of new information by relating it to more familiar content in the areas of thinking and creative problem solving (Emig, 1972; Honeck and Hoffman, 1980; Pollio and Smith, 1980). Others have acknowledged its integral role in reading comprehension (Burkland, 1964; Fisher, White, & Fisher, 1984; Foerster, 1974; Pearson, Raphael, TePaske, & Hyser, 1981; Pollio, Barlow, Fine, & Pollio, 1977; Reynolds & Schwartz, 1983; Robertson, 1973; Wiig & Semel, 1984) while others have described its capacity for promoting new relationships during writing (Haskell, 1987; Mulder, 1959; Stewig, 1966; Sweet, 1974). According to Turbayne (1962), one is compelled to find new strategies to comprehend the presumed conceptual incompatibility inherent in figurative language. These strategies, in turn, permit the regrouping of normal categories. Wiig and Semel (1987) recognize figurative language as a fruitful type of semantic adaptation, whereby it is possible to see similarities where others only see differences. Besides suggesting its use for improving reading, Wiig and Secord (1985) stress the need for students to be able to recognize and judge the applicability of figurative language to its context. Fisher et al. (1984) concluded that figurative language is an important element of comprehension, asserting that it should be included in a systematic and sequential reading programme. Burmeister (1973) and Beck (1987) recommended that instruction in figurative language be included as part of the school curriculum because of its role in advertising and propaganda. Hoffman (1980) concluded that figurative language can serve as a problem solving device while Gordon (1965) defined it as a heuristic in thinking, which is useful for hypothesis testing.

An additional link between education and figurative language relates to the proposal that figurative competence represents a necessary aspect of categorizing,

conceptualizing, learning, and understanding the world (Edie, 1963; Emig, 1972; Honeck, Case, & Firment, 1987; Honeck, Kibler, & Sugar, 1985; Petrie, 1979). Figurative competence is also thought to be indicative of a more general ability to engage in abstract reasoning (Brown, 1965; Honeck & Hoffman, 1980; Ortony, 1979) and creative thinking (Harrington, 1980; Paivio, 1979; Rothenberg & Sobel, 1980; Schaefer, 1975). Various developmental investigators (e.g., Billow, 1975; Cometa & Eson, 1978; Holden, 1978; Kogan, Connor, Grass, & Fava, 1980; Malgady, 1977; Piaget, 1955; Resnick, 1982; Smith, 1976) have examined the extent to which various cognitive attainments may bear either a causal or an overlapping relationship to figurative understanding. Nonetheless, despite suggestions inherent in this body of research that figurative language plays an integral role in language and cognition, education tends to view figurative language as the exclusive province of the English curriculum and the inability or unwillingness of educators to recognize the many uses of figurative language serves only to perpetuate the myth that figurative language is merely a simple linguistic comparison used as ornamental language. As the research implies, an important reason to investigate a student's ability to understand figurative language is that such an ability often has important educational implications beyond simply serving to embellish language.

The pervasiveness of figurative language in every aspect of human communication has been convincingly demonstrated by Gardner, Winner, Bechhofer, and Wolf (1979), Honeck (1980), Lakoff and Johnson (1980), Ortony (1980), and Pollio et al. (1977). Arter (1976) conducted an informal survey of school readers and found that figurative language occurred at the rate of about ten instances per thousand words. According to Boatner and Gates (1969) up to two-thirds of the English language is estimated to consist of, or be influenced by, figurative language. In an analysis of the figurative content of two reading and one social studies series designed for use in the third,

fourth, and fifth grades, Grosbeck (1961) found 582 figurative expressions present in the third grade, 837 in the fourth, and 1,337 in the fifth. This is a very high number considering that rarely is direct instruction given to help students to learn how to use or interpret figurative language (Wiig & Semel, 1984). Wiig and Semel (1984) also suggested that as reading material increases in difficulty the frequency of figurative language also increases, thereby making the comprehension of such language that much more important. Pollio et al. (1977) estimated that four instances of figurative language are uttered per speaking minute in free discourse over a variety of settings ranging from political speeches to school instruction while Pickens, Pollio, and Pollio (1985) estimated that by the time students reach high school, they are required to deal with figurative uses of language at the rate of five or more figures per page. Such strong evidence of the presence of figurative language in the students' educational environment indicates their ability to operate at only a minimal social, linguistic, and academic functional level without some understanding of figurative language. However, Pollio et al. (1979) concluded that students' textbooks offer few lessons dealing specifically with figurative language, that teachers offer little direct instruction in the mastery of figurative language, and that teachers' textbooks do not treat figurative language as a cognitive tool and provide teachers with little information about how to teach it.

This relative lack of concern over the formal teaching of figurative language is in marked contrast to the actual occurrence of figurative language in students' reading materials. Apparently, students are supposed to be able to produce, comprehend, and interpret figurative language without any direct instruction or understanding of the processes involved. In spite of the clear importance of figurative language for a wide variety of educational skills and goals there seems to be a general lack of concern over the figurative process in education. A reading of various Ontario Ministry of

Education Guidelines and support documents leads one to conclude that figurative language is not viewed, generally, as an integral aspect of the educational process. It would appear that educators have generally neglected to incorporate the implications from research on figurative language into curriculum planning and instruction; however, as the following discussion suggests, reasons for this neglect are not hard to trace.

One can conclude from the psycholinguistic and educational research of the 1960's that figurative language was viewed as an obstacle to be tolerated at best. The reasons for this attitude included the influence of the Behaviourist movement on education and its demand for data which could be reliably acquired and readily subjected to objective analysis. Accordingly, there was a preference for those aspects of language which more easily lent themselves to empirical methods of investigation and this product oriented approach generated quantitative data. In general, language was analyzed and language programmes were generated that focused primarily on syntax at the expense of nonlinguistic or nonliteral knowledge and pragmatic context (Gardner et al., 1978). In schools, the emphasis was, and to a large extent still is, on the direct teaching of grammar and vocabulary. Yet it is a mistake to view language as a set of skills to be established by drilling since such a view neglects the essential character of language which is its potential for expressing meaning. Blank, Rose, and Berlin (1978) suggested an approach that focused on increasing the student's ability to use language for classifying, predicting, and talking about nonpresent events.

Equally important was the dominant influence of generative-transformational linguistics or transformational grammar (Chomsky, 1957, 1965) which produced a bias toward the confirmation of linguistic constructs. The goal of linguistics was to isolate, segment, and classify the constituents of sentences without regard to meaning. Sentences were treated as literal inputs with meaning derived from a rule-based linking of the meanings of the component words. Thus, the study of language comprehension

focused primarily on understanding specific lexical and syntactic features of the sentence at the expense of understanding the functional relationships among sentences. Research focused on phonology (Chomsky & Halle, 1968; Jakobson & Halle, 1956) and a syntax-based linguistic theory (Chomsky, 1957, 1965) and to a lesser extent on semantics in the guise of deep structure. Within this literalist framework, figurative language was considered to be agrammatical because it would not fit neatly into the logical structure of a linguistic theory of the type advocated by Chomsky (1965) and Katz and Fodor (1963). However, such theories deal primarily with the literal level of meaning and are therefore restricted in their ability to capture the relation between literal and figurative meaning. In their concern for logical structure, these literalist theories deny creative possibilities. A figurative meaning cannot be derived by these theories as a composition of the literal meanings of the words. An example of how these theories are unable to capture the relation between literal and figurative meaning is provided by proverbs. The proverb, Great weights hang on small wires; an interpretation of it, Outcomes of important events often depend on minor details; and an instantiation of it, The outfielder just missed catching the fly ball when he tripped on a bottle. The winning run scored and they lost the game. (Hoffman & Honeck, 1980). The proverb, interpretation, and instantiation differ in words and structures, yet they are clearly related in conceptual ways that cannot be explained by theories that deal with the literal level of meaning (Anderson & Bower, 1973; Chomsky, 1965; Fillmore, 1968; Kintsch, 1974).

As a consequence, research focusing on how individuals process and understand figurative language was extremely limited. Nonetheless, despite this attitude, or perhaps in reaction to it, research in figurative language underwent a renaissance, beginning in the mid-1970's. Much of this research on figurative language focused on metaphors, almost to the exclusion of other figurative forms (Honeck & Hoffman,

1980; Ortony, Reynolds & Arter, 1978), and the majority of studies were, and remain, quantitative and discuss comprehension in terms of products or operational measures of how much a student understands rather than describe how the student understands figurative information (Honeck et al., 1985; Honeck, Riechmann, & Hoffman, 1975; Sternberg & Nigro, 1983; Tourangeau & Sternberg, 1982).

Proverbs have been used in intelligence tests, in the early work of Bühler (1908) and Piaget (1955) and in numerous studies connected with language disorders and schizophrenia (Resnick, 1982). There have, however, only been scattered attempts to identify the cognitive processes involved in their comprehension. As one attempt to address this situation, the present study shifts the focus from metaphors to proverbs and uses an information processing approach to focus on the interpretive process. Toward this end, and to highlight the issues involved, the following section compares metaphors and proverbs concluding in a definition of a proverb. Implicit in the following discussion is the notion that among the reasons for the dearth of proverb research is the fact that the word metaphor has been used as an umbrella term, and that often discussions of metaphors include related figurative uses of language such as proverbs, similes, idioms, and analogies. However, as the following will demonstrate, proverbs are not metaphors. As a consequence, much of the proverb research that has been done has not been grounded in an adequate understanding of what a proverb is, and more importantly, what a proverb represents.

A Comparison of Metaphors and Proverbs

This section examines metaphors and proverbs in terms of their representation and their function. Focusing on these two dimensions serves to highlight their distinctive features and to clarify the definition of proverb used in this study.

Figurative language can be produced in several forms of which metaphor is perhaps the most common. According to Richards (1936), metaphors are composed of two principal terms, the topic and the vehicle and the relationship between them, the ground. The topic is usually, though not always, in the subject phrase in the sentence and the topic can be explicit or implicit. The second structural component of a metaphor is called the vehicle. This is the part of the metaphor that makes a comment about the topic. The remaining aspect of a metaphor is called the ground of the metaphor and it is always implicit. The ground is created by constructing a relationship between the topic and the vehicle. For example, in the sentence He is a block of ice, "He" is the topic, "block of ice" is the vehicle, and "aloof and not intimate" is the ground. Proverbs are like metaphors, except they are general and they are topic-less. That is, the entire proverb is a vehicle term while the proverb's implicit topic is an indefinitely large number, or category, of events.

Perrine (1971) refined Richards' scheme and proposed a classification scheme in which proverbs are treated as a type of metaphor in which only the vehicle is explicitly stated. Perrine emphasized that the explicit topic and vehicle terms, that is the proverb's words and phrases need not be the intended topic and vehicle concepts. The concepts or domains may also be represented implicitly; therefore, technically, according to Perrine the proverb statement itself is the vehicle, while the topic is implicit. A paraphrase of a proverb, which says in a literal way what the proverb, that is the vehicle says figuratively, is also a potential statement for the implicit ground of the proverb. Proverbs may then be viewed as a type of metaphor which require a greater contribution on the part of the individual to the construction of a representation than is required for the type of metaphor in which both the topic and vehicle are explicitly stated. The implicit nature of proverbs and the processing demands are two features that distinguish proverbs from metaphors.

Often, proverbs are stated in the present or non-past tense. For this reason, they are temporally unrestricted in application. For example, to state that Bees have honey in their mouths and stingers in their tails is to make a claim whose figurative meaning applies from the indefinite past through the indefinite future. If restated as Bees had honey in their mouths and stingers in their tails, the claim loses much of its figurative potential. In general, indefiniteness of temporal reference serves notice that a general rather than a particular interpretation is required. The need for a general interpretation is also signalled by indefinite noun phrases, or definite noun phrases that have no particular contextual counterpart such as the four noun phrases in The monkey takes the chestnuts out of the fire with the dog's paw.

Figurative understanding, in general, can be considered a matter of solving problems that have ill-defined goals. That is, the problem solver is exposed to a sentence whose literal meaning may be used to construct a nonliteral meaning whose precise character is left unspecified. In the literature on problem solving, a distinction is often made between well-structured problems and ill-structured problems (Newell, 1969; Reitman, 1964, 1965; Simon, 1973; Sternberg, 1977, 1985). This distinction applies to figurative language as well. While not all researchers define the distinction in exactly the same way, a common thread running through all of the definitions is that problems are ill-structured to the extent that the individual must contribute toward their definition. Specifically, a problem may be regarded as ill-structured to the extent that an individual must construct the representation used to solve it. For metaphor, Searle (1979) proposed a three-stage model of nonliteral processing and claimed that the issue that needs to be resolved is how the sentence S is P (He is a block of ice) can mean S is R (He isn't a caring or intimate person) when S is the subject expression, or topic; P is the predicate expression, or vehicle; and R is the figurative meaning, or ground attributed to S. According to Searle there are three stages involved in

understanding a metaphor. First, the interpreter must determine whether a literal or figurative interpretation is needed. Second, the interpreter must use some strategies for computing possible values of R within a figurative set. Third, the interpreter must use some strategies to decide on the likely values of R and to determine which R value is likely to be a property of S (Janis & Bever, 1985).

Unlike a metaphor, a proverb can be presented without any supporting context and without a topic (Honeck, Voegtle, Dorfmueller, & Hoffman, 1980). Typically, a proverb is uttered as a comment on an event which is embedded in a social context. For example, if a mechanic and an adult are discussing the weak brakes on the adult's car, the mechanic may say, A stitch in time saves nine. The statement serves a clear communicative function. In effect, the mechanic has said, "I think the brakes should be fixed, and the sooner the better because it will be much easier to do now than later." In this case, the vehicle, which is the whole proverb, may be educational by virtue of telling the adult something new about the topic which in this case happens to be car brakes. In other cases, the significance of the topic may be clear, and the proverb functions merely to emphasize this significance. As well, the proverb stands in analogous relation to its referent situation: the relationships which hold between the parts of the proverb are declared to be equivalent to the relationships in the referent situation. Therefore, a proverb has the structure of a classical analogy a:b::c:d where a and b are terms of the proverb which share a relationship (::) with c and d, terms in the situation to which the proverb refers (Honeck et al., 1980; Resnick, 1982).

Accordingly, if the three-stage model proposed by Searle (1979) is applied to proverbs, then the problem of interpreting a proverb is one of figuring out how S (the topic, if there is one) is related to P (the vehicle of the proverb) can mean S is R, where R is the figurative meaning of P. Clearly, the S is R assertion is only implied by the speaker of a proverb, whereas the speaker of a metaphor makes it explicitly.

When a proverb has no immediate topic, the problem is one of explaining how P's literal meaning becomes R. Proverb comprehension begins with a conceptual representation which is the literal meaning of the proverb. According to Honeck and Kibler (1985) this complex representation provides information, along with the topic, background, and contextual information in general, which is used to construct an abstract, general, generative representation of the figurative meaning. This representation is basically the basis of a category whose members are interrelated through the representation.

According to Honeck et al. (1980), metaphors are rarely encountered outside of text or conversation and while the same applies to proverbs, the relationship each form bears to the larger context is quite different. Metaphors, especially part-sentence metaphors, have a spontaneous quality. They flow with and are integrated into the context. Nonetheless, they are specific to the context, and their meaning is particularized by it. The user of a metaphor, moreover, often does not intend that it be extended beyond the specific context. For example, in the sentence He is a block of ice, the metaphor applies only to the topic in question. The point of these considerations is that all metaphors are parasitic upon context inasmuch as they are identifiable only by means of it, and understandable primarily in relation to it. In this sense metaphors are considered to be context-driven.

Proverbs, in contrast, are used in different ways and for different purposes than metaphors. Proverbs typically comment on a context in order to make a point of general significance about it. For this reason, they are hardly spontaneous and may rely more than is the case for metaphor upon their user's conscious intention. Their successful interpretation in a single context in fact signals the creation of a group of instances. Significantly, in the absence of illustrative context, a proverb is more likely to be interpreted in a figurative way than is a whole-sentence metaphor. These several

observations strongly suggest that proverbs are not nearly so context-driven as metaphors. Proverbs function at a distance from context and are much less context bound. They are, in this sense, more knowledge driven.

The generativity of the figurative representation of a proverb is another crucial, defining property that distinguishes it from the representation that constitutes the meaning of a metaphor (Honeck & Kibler, 1985). The representation for a metaphor is generative but the generativity is specific to the topic of the metaphor. For example, the metaphorical meaning of He is a block of ice may apply to a large number of acts on a person's part such as a lack of emotion, sarcasm, and/or an unwillingness to be intimate, but its meaning does not apply to topics other than the person in question. In contrast, the figurative meaning of a proverb, such as A net with a hole in it won't catch any fish, can be generalized to include an indefinitely large range and variety of topics.

Proverbs are also much more flexible than metaphors and their flexibility may well be due to the fact that their topics are separate, distinct entities. In other words, proverbs are not necessarily dependent upon their topics and contexts of use. Thus, the context-driven character of metaphors localizes their functions within the context, while the knowledge-driven character of proverbs extends their functions to as yet unknown contexts. Within this framework, the proverb's primary function is to promote the development of an interpretation in the form of an abstract, generative theoretical base or concept used to group referentially and literally distinguishable events. The interpretation of a proverb not only reconceptualizes the nature of the topics or situations that fall within its scope, but in so doing, places them within a larger system. In this sense, the potential of a proverb is much greater than that of a metaphor.

Honeck et al. (1980) attempted to distinguish proverbs from metaphors and found many gray areas such as in the distinction between whole-sentence metaphors and proverbs where context and intended use were identified as key factors. Nonetheless, their comparison of metaphors and proverbs led to an operational definition of a proverb as:

> a pragmatically deviant, relatively concrete present-tensed statement used to create a theoretical perspective for grouping referentially and literally distinguishable events. (Cited in: Honeck & Hoffman, 1980, p. 150.)

To better understand this definition of a proverb consider the following three sentences: The surgeon's hand slipped and a major artery was cut; The shortstop tripped on a pebble, the ball scooted beneath his outstretched glove, and the winning run scored; The prime-minister, annoyed by an off-handed comment from the other country's president started a war. (Honeck et al., 1985). These sentences or instances are taken from different semantic domains but, more importantly, it should be clear that the similarity among the instances is not in the sentences themselves, but rather, must be derived from an interpretation which involves constructing a common relation among the three sentences. In this case, an interpretation such as The outcome of important events may depend on seemingly minor details appears to encompass the common meaning of the three sentences. Moreover, this meaning is a figurative meaning; in fact, the interpretation is one rendering of the figurative meaning of the proverb Great weights hang on small wires. In this way, a proverb is used to group referentially and literally distinguishable events. Once interpreted, the proverb acts as a complex name for a conceptual category of actual and potential instances, whose membership in the category is totally dependent upon the figurative interpretation. In this study, proverb is viewed as a name for a figurative interpretation or conceptual core that serves to relate events that are dissimilar on a literal level. That is, the

proverb is the name of a category whose members are related by virtue of a common figurative meaning. The figurative representation is a constructed figurative meaning which is most directly and best expressed by the interpretation of the proverb. The figurative meaning that is constructed is not directly due to the sentences nor their perceptual features but, rather, to the interpretive process.

The following section is a selected review of the research on proverb comprehension. While the research literature reveals much about the skills related to the production and comprehension of proverbs, it sheds little light on the interpretive processes involved.

Research in Proverb Comprehension

Karl Bühler (1908) used proverbs to investigate the nature of thought. Bühler used both question and answer as well as recall techniques. For example, his subjects were asked: "Do you understand, The most glowing colors in which the virtues shine are the inventions of those who lack them?" As well, his subjects introspected on their thought processes as they understood proverbs and as they solved proverb analogy problems. In these problems, Bühler first read his subjects a list of proverbs; then he read a second list and asked his subjects to recall a related proverb from the first list. If the first list included Cobblers wear torn shoes, the subjects would recall this statement when given Teachers have ill-mannered children. Recall of the first series, given the second, was usually excellent. That subjects could solve such problems suggested to Bühler that linguistic comprehension is more than just the linking of individual word meanings. He concluded that sentence understanding is an apperceptive process wherein knowledge meets the sentence half-way. Moreover the recall studies seemed to indicate that a proverb is remembered better if it is interpreted than if its deep structure is repeated.

Benjamin (1944) investigated the response of schizophrenics who were asked to orally interpret a list of 14 proverbs that were read to them, for example, When the cat's away, the mice will play. He developed a coding scheme for the interpretations and found the latter overwhelmingly literal and if not literal, then neologistic, incoherent, or reflective of personal preoccupations. However, of special significance was his view of proverb interpretation which is generally consonant with the approach used in the present study. According to Benjamin:

> The classic proverb...is built up of one or more substantive symbols, usually objects of nature or everyday life... combined with predicates which have varying degrees of figurative or literal value. The literal meaning of the proverb can be a simple statement of real or supposed fact, sometimes based on observation in nature, at other times containing a cause-and-effect relationship. In all cases, however, the objects as well as the actions are supposed to represent (symbolize) something else... As long as no real interpretation is offered, this symbolization plays no role. The subject can refuse entirely to enter into the problem.
>
> In order to make a true interpretation, however, the symbols must be translated into the respective figures, categories, and actions which they represent, a process which we have called, for the limited purpose of this inquiry, desymbolization. Following desymbolization, the meaning of the proverb can be expressed in various ways from the most specific and concrete examples through the general to the abstract. (pp. 79-81)

For Benjamin, the crucial process was desymbolization which he described as the difference between generalizing or responding to an immediate, concrete aspect of a stimulus and seeing the individual thing as representative of an entire, abstract category. Thus Benjamin differentiated mere generalization of the symbolic terms from full desymbolization, so that, for example, cat in When the cat is away the mice will play is generalized to animal or big animal but desymbolized to person in authority. Moreover, Benjamin discriminated experimentally between non-symbolic aphorisms (for example, Discretion is the better part of valor) which require restatement in simpler language and proverbs which require desymbolization. His essential finding was that the inability of schizophrenics to desymbolize appropriately resulted in consistently literal responses.

Werner and Kaplan (1967) suggested a process similar to that suggested by Benjamin (1944); however, their key terms were lexicalization and decontextualization. Both terms referred to the increasing tendency to perceive a word not as a thing anchored to a particular sentence or context, but rather, as a bearer of meaning in itself as well as a building block of meaning able to combine rather freely with numerous other words to form complex references or categories.

Extensive research in the area of proverbs and language disorders was done by Gorham (1956) using the theoretical framework provided by Benjamin (1944). Gorham devised a Proverbs Test in both a free response and multiple-choice format. In the free response format, the essence of the test was the conversion of concrete symbolism into concepts regardless of the appropriateness of the abstractions; "Bizarre or artistic conceptions were given the same value as more usual responses" (p. 3). The multiple-choice form was derived from actual responses of a normative population. It contained 17 symbolic proverbs and 23 non-symbolic aphorisms. The four choices for each proverb included correct and incorrect abstract and concrete alternatives:

> Strike while the iron is hot.
>
> a. Be quick and alert (abstract incorrect).
> b. Iron with a hot iron, a cold one won't work (concrete incorrect).
> c. That's when it bends the best (concrete correct).
> d. Do something when the time is right (abstract correct).

Each subject received both an abstract and concrete score. Elmore and Gorham (1957) used this multiple-choice format to separate normal and schizophrenic patients on the basis of abstract and concrete scores. Norms for the test showed a steady increase in performance from fifth graders to college students. They attributed this growth to increasing verbal ability: "an analysis of the factorial content of the tests which correlate with the Proverb Test indicates that this test is a relatively pure

measure of the 'verbal factor'" (p. 6). In particular, Elmore and Gorham characterized the test task as requiring "conversion of concrete symbols into verbal 'concepts' or verbal abstractions.' It would seem logical to assume, therefore, that this test measures 'abstract thinking' or the 'abstract function'" (p. 7). There is also a large block of proverb research that values the proverb for its richness as an item tapping verbal intelligence. The Gorham Proverbs Test has shown significant relationships to intelligence as measured by a word knowledge test (Elmore & Gorham, 1957; Gorham, 1956).

Proverbs appeared on the Stanford-Binet Intelligence Test (Termin & Merrill, 1937) beginning with the Average Adult level. Subjects were asked the meaning of three proverbs and a passing response required that the proverbs "be analyzed, abstracted, and applied to life situations." Norms established through the Stanford-Binet Intelligence Test indicated that almost all children below the age of 11 years and a majority of adult have difficulty interpreting even some familiar proverbs (Honeck et al., 1980). At the Average Adult level, performance on the proverbs subtest of the Stanford-Binet correlated about .75 with full scale performance (Terman & Merrill, 1973). Thurstone and Thurstone (1941) included a proverb subtest in their Factorial Studies of Intelligence that required subjects to indicate which proverb differed in meaning from a group of five proverbs. A group of students in grade 8 registered a factor loading of .4 on verbal comprehension while senior high school students registered a factor loading of .65 on verbal comprehension on this subtest.

Early developmental investigations of proverbial understanding often reflected the view that young children were simply unable to deal with figurative uses of words. For example, Watts (1944) stated that below the age of 11, it is unusual to find children with any real grasp of figurative language. Accordingly, Watts cautioned teachers against using figurative language or analogy as a teaching device because he believed

that children up to the age of seven years do not know the difference between living and nonliving things and, therefore, would confuse analogies based on this distinction. As a result, it was rare that preschool or early elementary level children were included in such investigations.

Thus, in Watts' (1944) investigation, 11-, 12-, and 13-year-olds (approximately 600 per group) were asked to read a list of 50 proverbs (e.g., The pot should not call the kettle black) and to select the appropriate interpretation for each sentence from among 4 alternatives. The purpose of this investigation was to determine if children over this age range would show an improving ability to interpret proverbs. As predicted, the children's accuracy did increase with age (with mean scores of 16.52, 20.94, and 25.20 for the three groups, respectively) although not even the oldest children approached mastery. This suggested that figurative understanding continues to develop past the age of 13.

Piaget (1955, 1959) also assumed that very young children would interpret figurative language in a literal manner and therefore examined proverbial understanding in children ranging from 9 to 15 years of age. Piaget used proverbs to investigate aspects of cognitive development in these children, particularly verbal syncretism. In his investigation, each child read a list of 10 proverbs (e.g., Drunken once will get drunk again) and was to select an appropriate paraphrase for each from an additional list (e.g., It is difficult to break old habits). Children were then asked to explain their interpretations of each proverb. The results were consistent with Watts' (1944) results in that literal interpretations were predominate among the younger children, particularly those between 9 and 11 years of age, and figurative interpretations became more frequent with increasing age. Piaget explained that the poor performance of the children at understanding proverbs was due to verbal syncretism. According to Piaget, verbal syncretism was a product of egocentrism and

occurred when two propositions were fused idiosyncratically into a common schema. The result was that the two propositions, in this case the proverbs and the paraphrases, implied one another. Piaget concluded that children apprehend and apply the whole before appreciating the analytic significance of it parts. Therefore, the literal understanding of a proverb and of a paraphrase created a general schema that united a proverb and a phrase in an idiosyncratic way without using a logical, analytic base. The Piagetian tradition places an emphasis on the transition from concrete to abstract or formal operations. That transition, which Piaget suggested occurs roughly at ages 11 to 12, is characterized by the movement away from the immediately given situation to a consideration of all possibilities arising from a situation. Piaget's demonstrations of verbal syncretism during the interpretations of proverbs were consistent with the view that only older children could fully understand figurative language. The reasoning skills necessary to comprehend proverbs were considered as aspects of the concrete operations and formal operations stages of intellectual development expected only of older children and adolescents. Yet Piaget's conclusions were probably more the result of choosing novel, often abstract proverbs as materials and of the potentially confusing matching task.

The Piagetian framework has been used extensively to study the relationship between figurative understanding and cognitive development. The traditional approach has been to examine a child's performance on various figurative tasks in relation to his or her stage of cognitive development. However, the nebulous results of studies using the Piagetian approach lead to an important issue that has interesting implications for developmental perspectives of proverb comprehension. Despite beliefs that the comprehension of proverbs does not develop until late childhood or early adolescence, it has been shown that even kindergarten children can understand certain proverbs under some conditions (Gentner, 1977). Regardless of how rudimentary children's

understanding of proverbs is, the fact that there are some conditions under which they can understand proverbs is inconsistent with efforts to relate proverb understanding to Piagetian theory, and especially to the claim that formal, or at least concrete operational, thinking is a necessary prerequisite for understanding. It is important to avoid confusing a child's ability to comprehend proverbs with the ability to verbally explain what it is that is comprehended (Gardner, 1974; Honeck, Sowry & Voegtle, 1978; Kogan, 1980).

Perhaps the earliest effort to resolve this issue was undertaken by Billow (1975). Citing Inhelder and Piaget (1964), he stated that the ability to make classifications based on the similarity of objects develops during the stage of concrete operations, whereas classifications based on proportionality can be made only during formal operations. Operating under the assumption that figurative comprehension is a type of classification or categorization skill, he proposed that similarity metaphors would be comprehended by a child in concrete operations, whereas proportional metaphors would be comprehended only by formal operational thinkers. He also proposed that proverbs would not be comprehended until formal operations because of their greater abstractness.

Billow (1975) compared children's understanding of proverbs to two types of metaphors. In his investigation, the 9-, 11-, and 13-year-olds (10 per group) were asked to explain the meanings of 12 proverbs (Make hay while the sun shines), 12 similarity (predictive) metaphors (A butterfly is a flying rainbow), and 12 proportional metaphors (My head is an apple without any core). Although performance steadily improved with age for all three types of figurative language, a hierarchy of difficulty was established in which proportional metaphors were consistently more difficult than similarity metaphors and proverbs were consistently more difficult than either type of metaphor.

To examine the relationship between concrete operational thinking and similarity metaphors, 5- and 7-year-olds were included in this phase of Billow's (1975) investigation in addition to the 9-, 11-, and 13-year-olds. Concrete operational thinking was assessed, using a class inclusion task in which the child was questioned about the objects mentioned in each of the similarity metaphors, for example, A butterfly is a flying rainbow. The questions were of the following form, where A refers to the first category, for example, butterflies, B refers to the second category, for example, rainbows, and C refers to the shared category, for example, colorful things: 1. Are there more (As) in the world or more (Cs)? 2. Why? 3. Are there more (Bs) in the world or more (Cs)? 4. Why? To receive credit, a child had to correctly answer both of the more questions and at least one of the why questions. Although performance on the class inclusion task was significantly correlated to comprehension of similarity metaphors, many of the younger children could explain the metaphors without correctly answering the class inclusion questions. Thus, it was concluded that concrete operational thinking, as assessed by a class inclusion task, was not a necessary precondition for the comprehension of similarity metaphors.

The relationship between formal operations and comprehension of proportional metaphors and proverbs was then assessed in the 9-, 11-, and 13-year-olds only. To assess formal operational thinking, a task of combinatorial reasoning was administered in which the child was given four circles, each a different color, and asked to combine them in as many ways as possible. A total of 16 different combinations could be made--4 circles taken 1 at a time, 2 at a time, 3 at a time, 4 at a time, and none shown at all. The degree to which the child combined the circles in a systematic fashion was an important scoring consideration. The results indicated that performance on combinatorial reasoning was significantly related to comprehension of proportional metaphors but not to proverbs. However, there was no evidence that the cognitive task was a necessary precondition to figurative understanding.

Several methodological problems with Billow's (1975) investigation raise questions about his conclusions. For example, many of Billow's 'proportional' metaphors did not involve analogies (Dreams passed in a parade, Death waves a pale flag) and were actually idiomatic expressions (Anger ate him up, Love captured him). In addition, most of the proportional metaphors expressed perceptual concepts, a distinction which may have affected their relative ease of understanding. It is important to note that the similarity metaphors, the proportional metaphors, and the proverbs were substantially different with respect to difficulty on all kinds of dimensions. For example, the proverbs involved more complicated syntactic constructions, a greater proportion of relatively low-frequency words, and far more complicated demands on knowledge of the world, be it physical, social, cultural, or proverbial knowledge. Therefore, the increase in comprehension with age may merely reflect a greater probability of prior acquaintance with more of the proverbs. Similarly, the proportional metaphors were much more complex in structure than were the similarity metaphors, and they too involved more knowledge of various kinds (Ortony et al., 1978).

In fact, Billow's (1975) study has achieved a level of notoriety due to its methodological problems. Criticism focuses on Billow's inadequate theoretical base as well as the demand on metacognitive skills which are as likely to be age and stage related as is the comprehension of figurative language. These conclusions allow one to speculate only that more difficult cognitive and linguistic tasks are performed better as children grow older. However, it is important to consider that the problems which plague Billow's (1975) study seem endemic to the study of figurative language in general.

Like Billow (1975), Holden (1978) investigated the possibility that formal operational thinking, as measured by various Piagetian tasks, was a prerequisite to children's understanding of proverbs. Seventy-nine subjects from grades 5, 7, and 9

participated. Proverbial understanding was assessed through administration of Gorham's Proverbs Test which included 40 written proverbs, each followed by 4 alternative interpretations. Formal operations were assessed through administration of a battery of tasks involving syllogistic reasoning, proportional reasoning, and mathematical probability. Holden's results were consistent with Billow's finding no evidence to support the hypothesis that formal operational thinking must be attained before proverbial understanding can occur. However, her results conflicted with Billow's, who administered only one measure of formal operational thinking, in finding significant correlations between proverbial understanding and formal operational thinking.

Also, working within the Piagetian framework, Cometa (1978) read proverbs to children in grades 1, 3, 4, and 8 and asked them to give an interpretation. Cometa argued that proverbial understanding requires the redefinition of the words within the proverb both with respect to one another and to context; therefore, he believed that proverbs draw upon combinatorial reasoning which is a formal operational skill. Only those children who had demonstrated combinatorial logic gave an adequate paraphrase of at least 5 of the 7 proverbs used. However, 7 of the 15 children who had not demonstrated combinatorial logic adequately paraphrased at least one proverb. Cometa suggested that perhaps formal operational reasoning is not the cognitive ability underlying children's comprehension of proverbs.

Richardson and Church (1959) investigated children's understanding of proverbs such as, An ounce of prevention is worth a pound of cure, Don't cross your bridges until you get to them, and You can't teach an old dog new tricks. The subjects in their investigation were 4 groups of approximately 16 children each, whose mean ages were 8, 9, 10, and 11 years. In this investigation, the children simply listened to the proverbs and were asked to interpret their meaning. Their interpretations were scored

according to various categories such as literal, or figurative, without considering the correctness of the response. As expected, figurative interpretations gradually increased with age as literal interpretations declined. However, not even the oldest children in this investigation offered a large number of figurative interpretations. Richardson and Church (1959) used this same procedure with a group of 30 adults. The adults tended to respond figuratively (abstractly) and preserved relationships analogous to those of the proverb better than the children. Finally, there was interesting microgenesis in the adult abstract responses; that is, they tended to begin rather crudely but then progressed to mature interpretations. The major contribution of this study is taxonomic. Richardson and Church (1959) demonstrated that the form of the response changed across different ages, yet they did not account for the change by identifying the process which allows for the emergence of new type of responses.

Evidence that conflicted specifically with the conclusions of Watts (1944), Piaget (1955, 1959), and Richardson and Church (1959) that young children are unable to comprehend proverbs was provided by Honeck et al. (1978), who questioned the validity of assessing children's comprehension of proverbs through explanation tasks. Noting that children often display discrepancies between their comprehension and production of language, these investigators designed a task whereby children could point to pictures to indicate their understanding of proverbs. They were also concerned with confounding variables related to the proverbs themselves, such as syntactic and semantic complexity. Thus, they developed a list of 10 proverbs having relatively simple syntactic structure and whose content words were familiar to young children. One such example was Bees give honey from their mouths and stings from their tails, which could be translated as 'a thing can be both good and bad at the same time.'

For each proverb, two pictures were presented, one illustrating the figurative meaning, and the other illustrating an incorrect interpretation or foil. Neither picture contained items that represented the literal meanings of the words in the proverbs. However, both were balanced in terms of the number and gender of the persons depicted. For example, the Bee proverb was correctly illustrated by a girl roasting a hot dog over a camp fire that was simultaneously burning her pants. The foil showed another girl opening a present as a ball was about to strike her.

The subjects were 20 students from each of the grades 1, 2, and 3, with mean ages of 7, 8, and 9 years, respectively. Each student was first shown the two pictures and was instructed to study them carefully. Ten seconds later, the examiner read the proverb and asked the student to point to the picture that meant the same thing. Practice trials were first given in which corrective feedback was provided. The results indicated above chance performance for all grade levels, with mean scores of 6.40, 7.25, and 6.85 out of a possible 10 points for the first, second, and third grade students, respectively. No differences in performance were seen as a function of grade level.

Although task demands were carefully controlled for by Honeck et al. (1978), it is interesting that not even the third grade students evidenced mastery of the proverbs; a finding that was left unexplained. Yet this is an important limitation and could suggest that the findings of previous investigators showing a steady improvement in proverbial understanding at least through adolescence (Piaget, 1959; Watts, 1944) may not be due entirely to an increasing ability to deal with confounding variables, or an increasing metalinguistic awareness. Thus, it would be interesting to administer the task designed by Honeck et al. (1978) to older subjects, perhaps to fourth through twelfth grade students, to determine if and when such proverbs are mastered. However, this limitation does not detract from the importance of this investigation in providing

evidence of proverbial understanding in children of an age range for which other investigators either failed to examine (Piaget, 1959; Watts, 1944) or had found a predominance of literal interpretations when explanation tasks were used (Richardson & Church, 1959).

Chambers (1979) also found evidence of proverbial understanding in young children using a two-alternative proverb-picture matching task quite similar to that of Honeck et al. (1978). Chambers, however, examined children from grades 1, 3, and 4 and tested a greater number of subjects in each grade level (n=60, 72, and 54, respectively). Chambers also added a task in which the subjects listened to nonfigurative statements and were asked to match them to proverb-picture pairs having the same meaning. For example, the statement The boy was flying his kite and forgot his homework corresponded to the proverb The sleeping fireman doesn't hear the fire alarm and its picture of two boys engrossed in a conversation while standing on a baseball field. Each subject received 10 proverb-picture matching trials and 5 nonfigurative matching trials. Two control groups were also added at each grade level: one group was asked to match nonfigurative statements to pictures without hearing the corresponding proverbs (picture-only control group) whereas the other group matched such statements to proverbs in the absence of their pictures (proverb-only control group). Each control subject received 5 trials on his/her respective task.

Mean scores on the proverb-picture matching task for the first, third, and fourth grade students were 5.30, 6.88, and 7.00, respectively, out of a possible 10.00. In contrast to those in the Honeck et al. (1978) study, the third grade students in this investigation performed above the level of chance. For the nonfigurative matching task, the mean scores for the students in the three grade levels were 2.50, 3.67, and 4.07, respectively, out of a possible 5.00. Again, the performance of the third grade students was significantly better than that of the first grade students, who did not perform above chance.

Although the results from Chambers (1979) were inconsistent with the results of Honeck et al. (1978), evidence of proverbial understanding in first graders was seen in the performance of the first grade proverb-only control group who unexpectedly performed significantly above the level of chance on this task with a mean score of 3.20. It was found that, for the subjects as a whole, performance on the proverb-only control task was significantly better than on the picture-only control task.

Brewer (1974) found that young children 6 to 14 years of age could pick the correct paraphrase of a proverb used as the conclusion to a short story or select the appropriate proverb to conclude such a short story. While performance improved with age, even the youngest children performed at better than chance levels on these tasks.

Brewer, Harris and Brewer (1976) used novel proverbs to test the hypothesis that proverbs are first understood on a literal level before they can be comprehended on a figurative level. The participants viewed pairs of sentences and each pair had a proverb, for example, Many leaks sink a ship and either a paraphrase of the literal meaning, for example, A lot of small holes can cause a boat to go under or a paraphrase of the figurative meaning, for example, A lot of small problems can add up to serious trouble. The task was to indicate if the two sentences in a pair had the same meaning. If the literal-first hypothesis is correct, the order of the two sentences should make a difference in verification response time since presenting the figurative paraphrase first and the proverb second should require additional processing relative to the condition where the literal paraphrase comes first. The results supported the hypothesis; however, they did do not reveal what cognitive strategies are involved in the interpretive process.

A study of the manipulation and comprehension of proverbs and analogical relations was conducted by Lemmon (1938). Working within an introspectionist framework, she used four adult observers trained in reporting their own cognitive

operations and products using terms like perceiving, imagining, inspecting, comprehending, searching, and flash. She used a variety of stimulus materials including cartoons, proverbs, and proverbs with settings; for example, They spent nearly two million dollars on advertising but as the directors said, A hook's well lost to catch a salmon. Her main concern was to establish whether the subjects understood the proverbs by analyzing them as analogies, that is, a pair of terms linked by a relation. She conceded that this was a theoretical framework for interpreting proverbs so she sought empirical evidence for this effect in the verbal reports of her informants. On the whole, their introspections did not provide any firm information on the process which led to solutions:

> There are sudden intimations of a "wider meaning" which occurred without any reported antecedents... Having received this intimation, O (observer) seeks to discover the remote significance, but reports are singularly lacking in evidence of the means which he uses... We cannot infer form the simplicity of the report, however, that the process was so uncomplicated. (pp. 315-316)

However, Lemmon's work did generate four valuable conclusions that fit the perspective of the present study. First, the process at work during the interpretation of proverbs is a unique one which she identified as symbolization:

> The symbolic object is actually depictive of no one member or part of what it represents. It gains its significance from its position in the comprehended whole, and, if encountered in isolation, would be devoid of meaning (e.g. "A hook's well lost to catch a salmon;" salmon does not ordinarily indicate any-desirable-thing-of-great-worth as it does in this case). (p. 333)

The essence of symbolizing "is a transition from the concrete and particular to the abstract and generalized" (p. 348). Lemmon uses the word symbolization to identify the process for which Benjamin (1944) and Werner and Kaplan (1950, 1967) use the words desymbolization and lexicalization, respectively. Second, the process of symbolization is engaged only with unfamiliar proverbs.

> All the reports substantiate our view that the recital of the familiar proverb is taken as a label for a topic, just as a word labels a thing or subject. The organism is no more concerned with the separate words, or even with all the words in their conventional signification, then it is concerned with the perception of separate letters or of the sound of the word "osmosis", which for the figurative significance as it did with the unfamiliar proverbs. (p. 319)

Third, Lemmon concluded that the output of the symbolization process may take one or two forms: (a) direct explaining of the meaning and relations in general terms, (b) citing of concrete examples or situations which express the same relation as the original proverb. Finally, Lemmon suggested that the richer the context in which the proverb is encountered, the more easily it is comprehended. In an overly rich context, however, the process ceases to be symbolization and becomes mere comprehension. Lemmon suggested that the familiar proverb permits a direct reading of the meaning from the situation with no need to resort to the higher-level process of symbolization. Therefore, symbolization is a graded process to the extent that it is executed in controlled, rather than automatized, fashion. The greater the degree of proverb familiarity and consequently automatization, the less the degree of symbolization involved in the interpretive process.

Honeck (1973) found better memory for a proverb if it was accompanied during acquisition by a conceptually good interpretation than by a repetition of the proverb's deep structure. Since the interpretations did not overlap their respective proverb bases on a deep structure, Honeck proposed that individuals apparently can encode an abstract, possibly imagery free, non linguistic form of a linguistic input which he termed a conceptual base. Honeck's conceptual base hypothesis was supported in a follow-up study by Honeck et al. (1975) that examined the conceptual base hypothesis and the effects of interpretive linguistic context on semantic memory. In the first experiment, it was demonstrated that proverbs presented in acquisition along with either a conceptually related or an unrelated interpretation are better prompted in recall by the former.

In fact, the stories were as effective as the subject-nouns in the proverbs themselves. For example, Laws catch flies but let hornets go free was prompted by the following story:

> Two people had their day in court. One was found guilty of smoking marijuana, was fined $500 and sent to jail for 6 months. The second person was charged with not reporting $100,000 in income. He was simply reprimanded by the judge and told to pay the government what he owed.

In the second experiment, subjects wrote interpretations of the proverbs and then received either the proverb's subject-noun or a brief story as a prompt. The stories, which illustrated an intended figurative meaning of the proverbs, proved to be as effective recall prompts as the subject-nouns from the proverbs. The results from Honeck (1973) and Honeck et al. (1975) imply two important features concerning the notion of a conceptual base. First, since any of a large number of different stories might have served equally well as prompts suggests that the conceptual bases formed by the proverbs are central in nature. Second, the results suggest that the conceptual bases are generative. Thus, each proverb is regarded as merely a surface manifestation of a deeper, more abstract conceptual representation. Therefore, instances of a proverb can be related by a common, abstract conceptual base. A conceptual base functions as a miniature theory that serves to relate conceptually a large number of literally and referentially distinct events. The notion of a conceptual base evolved into the Conceptual Base Theory of proverb comprehension (Honeck et al., 1980).

In the Honeck et al. (1975) study, support for the conceptual base hypothesis rested on more than the fact that the proverbs shared only conceptual relationships with the interpretations and the stories. In addition, the students' written interpretations were typically stated in abstract, general nonstorylike terms.

Furthermore, interpretation quality and recall performance were directly related, the more so for low-imagery proverbs. Basically, the better the students could explain a proverb to themselves, the better they were able to recognize novel, concrete instances of it. Theoretically, any of a large number of stories having the same figurative meaning could have served equally well as prompts. It is doubtful that the interpretations mediated recall since their very abstractness likely precluded their being remembered. More likely, a conceptual representation of each interpretation affected recognition of the figurative meaning of the stories and facilitated reconstruction of the literal proverb form.

Dorfmueller and Honeck (1980) had students study sentence families composed of a proverb, an interpretation of the proverb, and an instance, for example: A peacock should frequently look at its legs, Those who are outstanding in some ways should attend to their lesser qualities, The brilliant young woman didn't notice that others had trouble simply reading her handwriting, respectively. One family member was predesignated for the student as the recall prompt-to-be. The interpretations produced the best recall, but the proverbs and instances yielded about forty percent recall of content words from the other two family members. Even a group that received new instances as recall prompts, for example, The dandy-looking fine-suited young man wasn't aware that others didn't like him, was able to retrieve about twenty-three percent of the content words in the family. Dorfmueller and Honeck (1980) emphasized that the equivalent potency of the proverb and the original instance prompts suggests that the proverb is instance-like. As part of the same study, students were given sets of sentences, each set contained a proverb, an interpretation of the proverb, and two sentences which were instances of the proverb. The students were allowed to select from each set the one sentence which they preferred as a recall cue for the other sentences in each set. The interpretations worked the best as prompts,

but were themselves recalled last, at least for those students who selected some other prompt. Dorfmueller and Honeck concluded that the interpretation rather than the imageable instantiations was recalled first but served as a focus for a systematic examination of the conceptual relationships. In other words, the interpretation was recalled first but was used to generate the other members before being written down itself. In the Honeck et al. (1975), and the Dorfmueller and Honeck (1980) memory studies the students could not have used the instances to prompt memory and recall unless they had developed an abstract figurative understanding.

Riechmann and Coste (1980) investigated the role of imagery in the recognition of proverbs. They presented students with a list of novel proverbs such as Great weights hang on small wires. Some students were instructed to concentrate on the images which the proverbs literally suggested, while other students were instructed to concentrate on the implicit meaning of the proverbs. In a subsequent memory recognition test, the students were presented with a list of interpretations of the original proverbs for example, The outcome of important events can often depend on seemingly minor details. The students who were initially instructed to focus on the images did poorly, suggesting that imagery interfered at the conceptual level. The imagery instructions may have made it harder for students to recognize the meaning of the proverbs, especially for the more imageable proverbs. In addition, perhaps instructions to focus on the image which proverbs suggested kept the students at a concrete level, lowering subsequent recognition scores. The results suggest that an initial focus on an image can detract from comprehension of the implicit figurative meaning, whereas an initial focus on meaning makes the images subsequently seem more meaningful and salient.

Honeck and Kibler (1984) found that students who were provided either a four-term analogy, an instance, or both, along with a proverb during acquisition, were

better able to recognize novel, positive instances and to reject negative instances of the proverbs' literal meaning or to image this meaning. For example, the four-term analogy and instance for the proverb Not every oyster contains a pearl, were, respectively, an oyster: not every oyster contains a pearl:: pursuing a prize: only occasional success; No matter how many novels the exasperated author cranked out, he couldn't match the success of his first one. In their study, the analogy-plus-instance group outperformed the analogy group, the instance group, and the imagery group. Honeck and Kibler's (1984) results suggested that analogy is involved in relating one instance of a category to another or, more precisely, that the construction of an abstract category or conceptual base involves analogy. The results also suggest that imagery is not sufficient by itself for the construction of a conceptual base.

The studies by Honeck (1973), Honeck et al. (1975), Dorfmueller and Honeck (1980), Riechmann and Coste (1980), and Honeck and Kibler (1984) examined the role of imagery versus conceptual levels of thought in proverb comprehension. The results suggested that images are derivative and dependent upon interpretation processes for significance. For example, literal imagery may be aroused by a proverb, since proverbs are usually concrete; however, this imagery cannot take on a figurative significance unless additional processes operate on the imagery. Even in this case, literal-becomes-figurative imagery is not the figurative meaning, but simply a means of symbolizing it while imagery may sometimes yield information that can be used to construct a figurative meaning, when this happens, the imagery acquires a figurative value by default. Perhaps due to the concrete, imageable nature of materials used in much of the figurative language research, the role of imagery in the comprehension of figurative language has been overemphasized as opposed to the role of conceptual imageless thought (Hoffman, 1983).

Another interesting feature of proverbs is their relationship to abstract categories. One way to organize knowledge is to form categories. Categories consist of objects or events that are grouped because they are somehow related. Many of the tasks in proverb research require that students construct categories of figurative meanings; therefore, the studies discussed above are easily construed as studies of categorization, as well as of proverb comprehension. However, traditional views of the categorization process make extensive use of the perceptual (surface) features or attributes of events and, for this reason, are difficult to apply to non-perceptual categories such as those formed by the figurative meanings of proverbs (Honeck et al., 1985).

Honeck et al. (1985) proposed that there exist two types of categories: Type P categories and Type C categories. Type P, or perceptual categories, are generally concrete and are based on perceptual experience. This category includes most of the materials used in traditional figurative language and categorization studies. In contrast to Type P categories, Type C, or conceptual categories, are based on interpretive processes and the similarity among instances of a single C category is based on these processes. Similarity among instances does not exist in the instances or in features of them but arises from an individual's attempt to derive meaning from or assign meaning to the instances.

Consider the following examples taken from a study by Honeck et al. (1985): The sleeping security guard didn't hear the thieves, The missionary who didn't speak the natives' language converted no one, and The astronaut's suit didn't protect him from the high temperatures. Initially these sentences may appear quite dissimilar and not likely to constitute either a Type P or a Type C category. There are no common content words, no common semantic domains, and no common perceptual features. One could argue that they are instances of the concrete, perceptual category sentence since they have subjects and predicates and express what are in some sense complete

thoughts. In general, each sentence describes a happening within a relatively self-contained, conceptually distinct domain. Thus, the sentences relate certain events involving a security guard, a missionary, and an astronaut. From a literal perspective, there seems to be nothing that the sentences have in common. However, on a more abstract level it can be reasoned that lack of foresight is shown by the security guard, the missionary, and the astronaut. At a figurative level, the sentences reveal themselves as instances of a more complex Type C category, organized around a complex idea that can be expressed as A proper but faulty instrument won't help you achieve your goal. The Type C category is not perceptually based. It exists only by virtue of interpretive processes that enable the common, and in this case, figurative comprehension of these instances and any similar instances that might be devised. Honeck et al. (1985) provide evidence that the three sentences above are instances of the proverb, A net with a hole in it won't catch any fish, that they are instances of its interpretation, and that the interpretation is an accurate statement of the proverb's figurative meaning. It is very difficult and probably impossible to explain this complex network of similarities with reference to perceptual features, and no features suggest themselves as obviously common.

While traditional explanations of categorization based on concrete perceptual experience seem to adequately address perceptual categories, they prove inadequate when applied to abstract non-perceptual or conceptual categories such as those formed by instances of the figurative meaning of a proverb (see Honeck et al., 1985; or Honeck et al., 1982). The three views that have dominated the literature, the Classical View (Bourne, 1982), the Probabilistic View (Rosch, 1978), and the Exemplar View (Medin & Smith, 1981) are most distinguishable with reference to their representation assumptions, that is, the assumptions they make about the nature of the members that constitutes a category (Smith & Medin, 1981). These explanations of

categorization are restricted in their application since they were developed and validated using studies whose materials consisted almost entirely of concrete, perceptual stimuli such as schematic faces (Reed, 1972), random dot patterns (Posner & Keele, 1968), and geometric shapes (Medin & Schwanenflugel, 1981). Therefore, it should not be surprising that the Classical, Probabilistic, and Exemplar Views of categorization are unable to provide adequate explanations of more abstract conceptual categories such as those associated with the figurative meanings of proverbs.

The Classical, Probabilistic, and Exemplar Views are heavily dependent on the idea of features. This reliance is their major limitation when they are applied to non-perceptual or Type C categories. The utility of features as an explanatory construct is limited to the success with which it can be objectified. The problem is compounded with the introduction of abstract categories, since events that might be construed as features are infinitely more complex than traditional perceptual features. For example, no advantage is gained by allowing features to be anything.

Honeck et al. (1985) argued that for some abstract categories, such as those formed by instances of a proverb, category membership is mediated by an abstract, featureless conceptual base or microtheory. They generated sets of story-like instances that illustrated, with varying degrees of accuracy, that deeper meaning of a proverb. University students ranked the instances in terms of goodness with reference to the proverb, an excellent or poor interpretation, or an unstated abstract idea. The students who used the proverb or excellent interpretation as a reference agreed on how the instances should have been ranked. The rankings of the other groups were idiosyncratic. Honeck et al. (1985) attributed the agreement to the fact that the excellent interpretation mimicked the tacit microtheory that the proverb group students constructed on their own in the process of understanding the figurative meaning of the

proverb. Students who used the poor interpretation as the reference did not agree because their reference was not like the tacit microtheory. And those without a reference did not agree because each subject invented her/his own microtheory.

These results cannot be explained by traditional views of categorization because the instances were similar only on a figurative level. Moreover, the instances sampled non-overlapping literal domains. No common features suggest themselves in The missionary who didn't speak the natives' language converted no one and The sleeping security guard didn't hear the thieves. Yet both were ranked as good examples of the proverb A net with a hole in it won't catch any fish and its excellent interpretation A proper but faulty instrument won't help you achieve your goal.

In an earlier investigation, Honeck et al. (1983) had studied the effect of category width on transfer performance. Students learned several proverb categories, that is, figurative meanings via sets of concrete story-like instances. The sets were either wide, if each of the instances in the set was from a different literal domain, or narrow, if all the instances in the set were from the same literal domain. During transfer, the students identified target instances based on their figurative meaning alone, even though some of the transfer instances were about the same literal domains (topics) as the acquisition instances. In general, performance was better when the acquisition set was wide, though that advantage did not materialize for target instances that sampled from old literal domains and experience with narrow acquisition sets was virtually no help in detecting target instances that sampled from novel literal domains. In a sense the students rejected the traditional notion of features, in this case, common semantic domains, in favour of an abstract criterion. Honeck et al. explained their results with reference to a microtheory. The connections between novel, literally discrepant but figuratively consonant instances could have been made only with reference to an abstract imageless, generalizeable microtheory. Clearly the traditional views of categorization could not account for these results.

Kibler (1984) provided additional support to reject the traditional, feature-centered views of the categorization process in a study that investigated the structure of abstract, conceptual, categories. She stated that the instances that Honeck et al. (1983, 1985) used in their investigations were constructed without using an explicit microtheory as a guide. Evidence for a common microtheory was obtained only indirectly through the highly consensual ranking patterns of the proverb and excellent interpretation groups in one investigation (Honeck et al., 1985) and highly accurate transfer performance in the other investigation (Honeck et al., 1983). According to Kibler (1984) if it were possible to explicate the common microtheory, then it would be possible to make empirical predictions about the degree of category membership, and the idea that a conceptual base is at the core of conceptual categories or figurative meanings would receive stronger support.

The focus of the Kibler (1984) study involved complex categories formed around the figurative meaning of a proverb. At issue was whether the figurative meaning of a proverb category could be conceptualized as a microtheory, that is, as a set of interrelated components or conditions that together would regulate category membership. The idea was to construct a potential microtheory and apply it to story-like instances of a proverb. If the conditions constituted an accurate expression of whatever regulates membership in proverb categories, then applying the conditions to the stories should yield the same decisions about their comparative category membership as are obtained when the proverb itself is applied to the stories. Students in a Rating Group rated the extent to which the stories embodied the components. These ratings were converted to ranks such that the more components a story entailed, the better its rank. Students in a Ranking Group ranked the stories associated with a single proverb, in the absence of the explicit components, according to how well they illustrated the proverb's figurative meaning. Students in these ranking groups agreed

on the order of the stories, and this order was highly correlated with the ranks derived from the component ratings. These results suggested that proverb categories, as one type of figurative category, are organized around microtheories about the relationship among proverb elements as symbols.

Again, the traditional approaches to categorization cannot account for these results. According to Kibler (1984) the Classical View fails because the categories were not well-defined or binary, a necessary corollary of defining features. The Probabilistic View fails because the microtheory is not the same as a central tendency or prototype. The microtheory is the product of interpretive processes that allow one to understand a story as an instance of a proverb. The central tendency of the Probabilistic View seems to result from abstraction processes that have little in common with interpretive processes, outside of the fact that both are involved in arbitrating category membership. The Exemplar View fails because it does not explain how a single story or a set of stories that are disjunctively represented could assimilate other stories that were literally dissimilar but figuratively similar.

However, the Conceptual Base Theory (Honeck et al., 1980) accounts for Kibler's (1984) results by invoking a conceptual base or microtheory. In order to rank the stories consistently in the Kibler (1984) study, the students in the Ranking groups must have constructed a common tacit figurative meaning or microtheory for the proverb. The questions that the Rating groups answered ultimately yielded sets of Standard Ranks that were much the same as the Ranking groups' ranks. Hence the questions were effective in directing the students to aspects of the stories that would discriminate them just as the Ranking group students had. Therefore the conditions on which the questions were based must have constituted accurate expressions of the tacit microtheories that the Ranking groups' students used. However, Kibler (1984) makes no claim that the conditions actually constitute the microtheory that was used. Rather,

the claim is that it is theoretically and practically useful to conceive of a microtheory as a set of conditions around which a conceptual category is organized. Honeck et al. (1985) state:

> ...it is possible, even likely, that there are no direct connections between the instances. Instead, instances are similar to the extent that they are interpreted in similar ways and ultimately assimilated by a common conceptual base. (p. 159)

As an approach to understanding proverb comprehension and, by extension, categorization, the Conceptual Base Theory offers a more adequate treatment of abstract categories such as those suggested by proverbs than that found in traditional views (Smith & Medin, 1981). Furthermore, Honeck et al. (1980) and Honeck et al. (1985) suggest that a summary representation in the form of a conceptual base is the direct result of interpretive processes brought to bear on uncommon events. In the case of a proverb, the indefinitely large set of concrete instances that capture its figurative meaning constitutes a category but only because the interpretive processes used to comprehend a particular instance yield essentially the same conceptual base that would result had they been applied to any other instance in the category. It is the conceptual base and the interpretive processes that give it birth, that provide the mechanism of categorization and serve as the focus of this study.

The Conceptual Base Theory of Proverb Comprehension

The Conceptual Base Theory (Honeck et al., 1980) describes proverb comprehension in terms of a sequence of cognitive processes that result in an abstract, generative, conceptual base, that serves to relate events that are dissimilar on a literal level. The sequence consists of four phases: 1. the Problem Recognition Phase, 2. the Literal Transformation Phase, 3. the Figurative Phase, and 4. the Instantiation Phase. Phase 1 or the Problem Recognition Phase is initiated when an individual is confronted with a statement whose literal meaning is inappropriate to the verbal scenario. If, for

example, in telling a friend about a lazy, irresponsible colleague who received a promotion one gets the response, The best pears fall into the pig's mouth the problem is to reconcile the apparent anomaly. Here, the individual is confronted with a relatively concrete, present-tensed statement that is pragmatically deviant; that is, the statement does not appear to fit the context. The context can be relevant to the statement (relevant-context situation), as in the example above, in the sense that the given information is potentially relevant to the statement, or the context can be irrelevant to the statement (irrelevant-context situation) in the sense that one is asked to interpret the statement in the absence of information in the immediate perceptual or memorial context (for example, one is asked to interpret The best pears fall into the pig's mouth). In both the relevant- and irrelevant-context situations, rather than rejecting the statement, under the press of the Cooperative Principle (Grice, 1975), the individual believes that the statement is serious and is about something. Assuming this circumstantial given, the individual who must interpret the statement has a problem to solve, albeit an ill-structured one.

In the relevant-context situation, problem solving is guided by the context. Assuming that the interpreter recognizes the problem, then the task becomes one of reconciling the statement with the context. However, the context may be more or less convergent upon the statement. Honeck et al. (1980) identified three distinct cases of this convergence of relationship. In Case 1, the interpreter knows only the context is relevant. Here the literal statement(s) serves to organize the context or to shed light upon it–the statement helps to parse reality and to create properties compatible with transformations upon the literal statement. In Case 1, the context presents no topic. In Case 2, the topic is already known and the statement serves to emphasize it. In Case 3, the topic is salient and the statement serves as further emphasis. The statement as proverb is redundant but there is still a problem to be solved. According

to Honeck et al. (1980), depending upon which case obtains, problem solving will be more or less guided and smooth.

In the irrelevant-context situation, the interpreter realizes that there is a goal to be met for which the statement, taken literally, is irrelevant, but which only apparently violates maxims regarding relevance and sincereness. The interpreter also realizes that the literal statement can be used, somehow, to meet the undefined goal. Thus, in this situation, the adoption of a metalinguistic perspective, that sees language as a tool to be used during problem solving, would appear to be facilitative of, if not prerequisite to, further problem solving. Honeck et al. (1980) concluded that it is the absence of such a metalinguistic awareness in young children that explains why they have difficulty interpreting, not to mention explicating, their interpretation of proverbs. As well, because the context is irrelevant to the statement, there should be significant individual differences in the problem solving strategies employed and in their results.

Regardless of whether the literal statement is interpreted in a relevant-or irrelevant-context situation, there is a tension or incongruity created by the apparent anomaly. For example, suppose A says, I know a woman who worked so hard helping others that she ruined her own health in the process, and B refutes with, A candle lights others and consumes itself. If A follows the Cooperative Principle (Grice, 1975) and assumes that B is sincere and is saying something relevant, then A has generated an ill-structured problem. Realizing that B was not talking about candles in any ostensible sense, A develops a figurative processing set and will use the literal proverb and contextual information to reconstruct B's meaning. This leads the interpreter into the second, or the Literal Transformation Phase, during which the literal proverb information is elaborated and reorganized. During this phase, literal elements of the statement are gathered in the literal statement field and contrasted with pragmatic contextual elements, their associations and inferences which define the context field.

Frequently the tension between these fields is mimicked by tension within them, since proverbs often contain two tensive or contrasting ideas (Honeck & Kibler, 1984). For example, there is a contrast between the inferred beauty of a peacock and the inferred ugliness of its legs in the proverb A peacock should frequently look at its legs. In A candle lights others and consumes itself, the contrast is between lighting others on the one hand and being consumed on the other. This contrast is within the literal statement field of the proverb and is compared in the same format with a contrast in the context field. The context field consists of potential instances and/or verbal interpretations in the immediate perceptual or memorial context. Honeck and Kibler (1984) suggested that since two contrasting ideas are usually formed within each field, an analogical format is frequently used to frame the problem. For example, the proverb, A candle lights others and consumes itself suggests the following analogy, A candle lights other candles: the candle consumes itself:: the woman worked hard to help others: the woman ruined her own health in the process. This sequence is similar to Spearman's (1923) analysis of the three processes of analogical reasoning. The first process, apprehension of experience corresponds to the encoding of each analogy term, while the second process, eduction of relations, is the awareness of a relationship by which terms can be linked. The third process, eduction of correlates, is the application of the inferred relation. The meaning is not in the analogical structure; rather, the analogical structure is the form from which the relationship and consequently, the meaning, is derived.

Honeck et al. (1980) proposed the analogic format as a useful model of the comparison process between literal and context elements. Because two contrastive lines, or ideas, usually develop, four-term analogies, that is, A:B::C:D, seem appropriate where the two contrastive ideas serve as either A and B, or C and D terms. However, Honeck et al. (1980) and Honeck and Kibler (1984) make no claim

that individuals consciously invoke an analogy format or recognize the contrast as an analogy problem during the interpretation of the proverb. Rather, it is suggested that an analogy format is useful in theorizing about the interpretive process. The analogy format represents an assertion that a relational structure that normally applies in one domain can be applied in another domain (Gentner, 1983; Sternberg, 1985; Tourangeau & Sternberg, 1981).

The actual comparison of the literal statement with the context field inaugurates the third phase or the Figurative Phase. During the Figurative Phase, the problem recognized in the Problem Recognition Phase and possibly represented in an analogy format in the Literal Transformation Phase is resolved. Here, the basis for an analogical relationship between the contrasting sets of ideas is created. It is as if the proverb explicitly presents the A and B terms of a four-term A:B::C:D analogy, while the interpreter's task is to desymbolize these terms in a figurative way in order to realize the relation between the terms. This process amounts to constructing the implicit C and D terms. In the proverb, A candle lights others and consumes itself, a solution to the analogy, a candle lights other candles: the candle consumes itself:: the woman worked hard to help others: the woman ruined her own health in the process would enable an individual to understand that commonality that links the proverb and the statement or instance of its figurative meaning, that is, The woman worked hard to help others but ruined her own health in the process. The interpretation or solution, in this case, the idea of doing something beneficial but being destroyed as a result, is an abstract structure or conceptual base. According to Honeck et al. (1980) these structures function as theories that become independent of their original fields yet integrate them by explaining their common significance. The conceptual base allows the individual to recognize other figuratively related but literally distinct instances as examples of the proverb. The conceptual base is abstract and general because the

contrasting ideas in the literal and context fields cannot be pattern matched on a literal or perceptual basis. The conceptual base is also generative in the sense that it can be extended and applied to novel events or instances.

In the Instantiation Phase, the conceptual base is extended to new events, which, if captured by the theory, become instances of it. Application of the conceptual base to novel instances results in its continued refinement and the application of the base to novel instances implies that the base is generative. Consequently, the construction of a conceptual base is a prerequisite for instantiation and instances could neither be recognized nor generated without successful resolution of the Figurative Phase. The Conceptual Base Theory (Honeck et al., 1980) proposed that analogies are a common format by which information is integrated during the Literal Transformation Phase and solved during the Figurative Phase; however, Honeck and Kibler (1984) and Honeck et al. (1980) offer only intuitive and indirect empirical evidence to support this proposal.

According to the Conceptual Base Theory, complete understanding of a proverb requires that a literal statement be recognized as incongruent in some context, that the statement and the context be transformed, such that a miniature theory or conceptual base arise that resolves the incongruity, and which can be used for recognizing and producing novel instances. While the four phases that comprise the Conceptual Base Theory are consistent with the research reviewed above Honeck et al. (1980) state that "...each phase involves a number of sub-processes whose nature and organization is less clear." (p. 151).

Summary

Figurative language is pervasive across all aspects of human communication including educational texts and teacher instruction yet figurative language receives little recognition as an integral aspect of the educational process. A number of factors have been suggested as reasons for this neglect. Traditionally, attempts to understand

figurative language competence have been based on product scores or comprehension reaction times and the interpretive process itself has rarely been considered; consequently, knowledge about the information processing components involved in the interpretive process is lacking. Proverbs are one form of figurative language that has been largely ignored yet from an educational perspective proverbs are particularly worthy of study since the interpretation of proverbs requires an ability to translate concrete symbols into generalized, abstract categories or concepts. Thus, proverbs are important not only for what they say but also for what they represent. According to Honeck et al. (1980), "...someone who fully understands a proverb has solved a large problem as well as a number of smaller ones. In general, we see linguistic understanding as requiring the acquisition and use of problem solving skills." (p. 151).

The results from research that has been done on proverb comprehension parallels the results from other figurative language and analogy research that in turn have implications for this study. First, much of the research on proverb comprehension has employed either semantic judgment tasks, memory tasks, or comprehension reaction time tasks while few studies have focused on the interpretive process. Second, well-known or frozen proverbs do not seem to require any figurative sense to be used appropriately. In extreme cases, an individual may not understand a proverb at all and yet be able to use it coherently in context. Therefore, any study that investigates the interpretive processes associated with proverb understanding should utilize unfamiliar proverbs with minimal context cues to engage figurative processing. Third, analyses of proverb explications does show the positive impact of maturing linguistic and cognitive structures on proverb comprehension just as they do in the comprehension of other figurative forms. However, general linguistic or cognitive development cannot account for the specifics of proverb comprehension. It would seem that to investigate cognitive/linguistic skills by making demands on

metacognitive/linguistic skills is not a very promising approach. Thus, if students can explain how they comprehend something, then one can draw inferences about their comprehension skills as well as their skill at understanding their comprehension and articulating it. But the fact that an individual cannot report how he or she understood something does not in itself justify the conclusion that it was not understood. Unfortunately, generalizations of this kind are widespread throughout the literature which suggests that a reworking of theories of cognitive development may be required. Fourth, little is known regarding the processes involved in proverb understanding beyond the simple fact that receptive comprehension precedes interpretation and explication, and that an individual's ability to interpret and explicate increases with age. However, what the literature does suggest is that a basic ability required for proverb understanding is the comprehension of the relationship which links the explicit and implicit terms of a proverb. Fifth, proverb interpretation can be recast as a categorization process in which the primary function is the development of an abstract, generative, conceptually-based category. The fundamental and unique characteristic of this category is that its very existence is due to interpretive processes. Finally, while the interpretive process plays a central role in the construction of a figurative meaning, there have been few attempts to provide a formal characterization of the information processing components involved in the interpretation of proverbs. The Conceptual Base Theory (Honeck et al., 1980) represents one attempt to provide a formal characterization of the interpretive process. As an approach to understanding proverb comprehension, the Conceptual Base Theory offers much more insight into the interpretive processes associated with figurative understanding than either linguistic theories that focus mainly on the literal level of meaning or traditional theories of categorization which are based mainly on concrete, perceptual experience. While linguistic materials have been used in studies of categorization these materials are

almost exclusively single words rather than larger linguistic constructions such as those found in proverbs.

The four-phase sequence proposed in the Conceptual Base Theory suggests that the interpretive process might be represented as a succession of events. In this perspective, the Conceptual Base Theory encompasses most aspects of information-processing research since it describes how an individual uses problem solving processes to construct the abstract conceptual base required to connect events that are dissimilar on the literal level. Of particular interest is the identification and description of the sub-processes, in terms of information processing components, involved in the resolution of the Figurative Phase of the Conceptual Base Theory for it is suggested that it is during this phase that elements of a proverb are desymbolized in a figurative way to realize a relation between the terms of a proverb which, in turn, is used to construct a conceptual base. According to the theory, the construction of a conceptual base is a prerequisite for instantiation and instances could not be recognized without successful resolution of the Figurative Phase. In the following section, a framework is described that can be used to identify and describe the sub-processes of the Figurative Phase in terms of elementary information processing components.

Conceptual Framework

The most appropriate conceptual framework within which to study the cognitive sub-processes used during the Figurative Phase of proverb interpretation is that of information processing. Information processing is not a unitary theory but is an umbrella term used to describe a number of approaches whose focus is on the flow of information from input to output. Information processing models tend to emphasize, in varying degrees, structure and process; however, a common theme of both of these

aspects is their emphasis on understanding performance in terms of underlying dynamic cognitive processes. The structural models tend to describe the flow of information through a compartmentalized memory system (Anderson, 1983; Chi, 1976; Frederiksen, 1984; Klatzky, 1984; Simon, 1974). Specific characteristics of the compartments determine both the manner in which information is processed and the amount of information processed. The information processing models oriented toward process are chiefly concerned with the cognitive processes or components which are involved in the transformation of information from input to output (Greeno, 1978; Pellegrino & Glaser, 1979; Spearman, 1923; Sternberg, 1977, 1979, 1985). Therefore, information processing models oriented toward process are concerned with (a) identifying elementary components, and (b) determining how such components are combined to perform a selected cognitive task.

Within this information processing framework, a method has been provided for the collection of data (Ericsson & Simon, 1984) and methods have been suggested for task analysis to allow problem solving to be analyzed and decomposed into a sequence of identifiable stages (Glaser & Pellegrino, 1982; Greeno, 1980: Honeck et al., 1980; Larkin, 1980; Newell & Simon, 1972; Sternberg, 1985). The implications for the development of instructional programmes based on the results of task analysis and a better understanding of cognitive development in general are well documented (Brown & Ferrara, 1985; Feuerstein, 1979; Frederiksen, 1984; Gardner, 1985; Kail & Bisanz, 1982; Pitt, 1983; Rigney, 1980; Schoenfeld, 1985; Siegler, 1986). What is interesting about information processing research is not only the consensus that highly similar processes are involved in solving various kinds of problems across various domains, but the consensus regarding what these processes are. Invariably, the processes, although presented in a more elaborate format, essentially reflect the processes proposed by Spearman (1923).

Spearman (1904) had factor analyzed a variety of inductive reasoning tasks including proverbs and analogies and observed sizable positive intercorrelations between tests of different abilities. He proposed that these intercorrelations were a reflection of a common or general factor accounting for performance, which he labelled "g". In 1923, Spearman specified three basic processes underlying this general factor. The three basic processes included: apprehension of experience, eduction of relations, and eduction of correlates. These processes have also been described as encoding a stimulus; inferring relations between two stimuli; and applying a previously inferred relation to a new stimulus so as to create an analogue to the previously inferred relation, respectively (Sternberg, 1986). These cognitive processes operate in concert yet they can be decomposed into a number of different elementary components; however, while these elementary components can be identified, they are, in isolation, insufficient to account for human performance.

For example, following Sternberg's (1985) evidence that understanding the relationship on which an analogy is based is crucial for solution, it seems reasonable to extrapolate that the most basic ability required for proverb solution is comprehension of the relationship which links the concrete terms of proverb. This process is identical to Spearman's process of eduction of relations and merely relates to the concrete meaning of the terms of the proverb. Thus, the student who cannot determine the relationship between a net with a hole and won't catch any fish in the proverb, A net with a hole in it won't catch any fish, is presumed to be incapable of comprehending any aspect of the proverb. The next process in Spearman's theory is transfer of relations which is the ability to equate the relationship which holds between the concrete terms of the proverb with other concrete terms. For example, a net with a hole and won't catch any fish might be equivalent to the fireman's suit and didn't protect him from the high temperature. One explanation of how these relationships

are realized is provided by the Conceptual Base Theory (Honeck et al., 1980) which, in turn, can accommodate Spearman's (1923) paradigm.

Any complex task requires that an individual organize or categorize information to function effectively. By dealing with meaningful or related units of information rather than with isolated bits, more effective processing becomes possible. The effective implementation of processing strategies is dependent on the individual's domain specific declarative and procedural knowledge (Greeno, 1980; Larkin, 1980). Chi (1981) suggested that cognitive development is largely the increment of declarative and procedural knowledge. Research that focuses on individual differences in problem solving between high and low ability problem solvers (experts and novices, respectively) across a variety of domains has established that the richness of the declarative and procedural knowledge base is central to differences in performance. The results of such research suggest that expert problem solvers do not use the same information processing strategies and techniques as do novice problem solvers. For example, Chase and Simon (1973) replicated deGroot's (1965) finding that master chess players reconstructed with greater than 90% accuracy midgame boards they had seen for only 5 seconds. They observed that master chess players recalled clusters or categories that formed attack or defense configurations whereas beginners lacked the skill to form such abstract representations. McKeithen, Reitman, Rueter, and Hirtle (1981) found that intermediate programmers clustered the words of a programming language by concept, whereas novices clustered the same words alphabetically. Strategy differences between experts and novices were also reported by Adelson (1981) who found that expert programmers used abstract, conceptually based representations when attempting to recall programming material whereas novices used more concrete representations.

Differences between experts and novices have also been found in research on learning mechanisms in physics (Chi, Glaser, & Rees, 1982), arithmetic (Brown & Burton, 1978), algebra (Lewis, 1981), and geometry (Anderson, Greeno, Kline, & Neves, 1981). For the most part, these studies show that experts restructure the elements of a problem solving task into abstract schemata that are not available to novices, who focus principally on the surface elements of a task. Thus, experts replace complex sub-elements with single schemata that allow more abstract processing. As with other complex skills, the successful interpretation of proverbs requires that individuals organize a set of related subtasks and their components into related units or phases (Honeck et al., 1980). If proverb interpretation were discussed using an expert-novice paradigm, experts would be expected to restructure the elements of a proverb into an abstract conceptual base not available to novices, who would focus principally on the perceptual features or surface elements of the proverb.

The Conceptual Base Theory provides an information processing framework for studying the interpretive process by suggesting that the interpretive process can be segmented into four distinct phases or episodes: 1. the Problem Recognition Phase; 2. the Literal Transformation Phase; 3. the Figurative Phase; and 4. the Instantiation Phase. However, the Conceptual Base Theory provides only a global view of the interpretive process and as Honeck et al. (1982) state "...the details of the phases postulated by the theory need to be specified more precisely." (p. 142). Since it was not designed to identify elementary information processing components, it cannot describe how these components are involved in the construction of an interpretation of a proverb. Therefore, a typology of cognitive processes proposed by Tourangeau and Sternberg (1982) that is componential in nature and represents a form of task analysis was examined to determine if it would complement the framework provided by the Conceptual Base Theory and if it would provide additional information about the interpretive process.

The basic unit in the componential framework is the information processing component (Tourangeau & Sternberg, 1982). A component is an elementary information process that operates upon internal representations of objects or symbols (Newell & Simon, 1972; Sternberg, 1977, 1980, 1985). According to Newell and Simon (1972) and Sternberg (1985) components are elementary in the sense that they are not further broken down into simpler processes by the theory under consideration. Thus, the desired level of theorizing will determine what is considered elementary enough to be labelled a component. Accordingly, a given component may or may not be elementary, depending upon the theoretical context in which it is presented. The component may translate a sensory input into a conceptual representation, transform one conceptual representation into another, or translate a conceptual representation into a motor output. Sternberg's (1985) componential framework involves three kinds of components: metacomponents, performance components, and knowledge-acquisition components.

Metacomponents are higher-order, executive processes used in planning, monitoring, and decision making in task performance. The metacomponents identified by Sternberg (1985) include: recognition of what the problem is that needs to be solved; selection of lower-order components for task performance; selection of a strategy for combining lower-order components; selection of a mental depiction of information upon which the components and strategy can operate; allocation of componential resources; solution monitoring; understanding feedback; figuring out how to act upon feedback; and acting upon feedback. Sternberg suggested two developments that are evident as children mature and as novices gather expertise in a particular area of problem solving: 1. they become more nearly exhaustive in their processing of information presented in a problem, and consider all or almost all of the information presented rather than just a subset of it (Brown & DeLoache, 1978; Siegler, 1978;

Sternberg & Nigro, 1980); and 2. they spend relatively more time in planning how to go about solving a problem, and less time in actually solving it (Chi et al., 1982; Larkin, McDermott, Simon, & Simon, 1980; Sternberg, 1981). This latter finding suggests that as individuals mature and as they gain expertise in problem solving domains they spend relatively more time on higher-order metacomponential processing, and less time on lower-order componential processing.

Performance components are always under the direction of the metacomponents and are used in the execution of various strategies for task performance. The actual working through of the problem one has decided to solve, in the way one has decided to solve it, is done using a set of performance components. Sternberg (1985) suggested that performance components tend to organize themselves into three stages of task solution (encoding components; combination and comparison components; and response components) that appear fairly general across tasks. Tourangeau & Sternberg (1982) suggest seven performance components that are common across metaphor comprehension, analogical reasoning and other inductive reasoning tasks: 1. encoding (perceiving and storing information), 2. inferencing (recognizing the similarities and differences between two terms of a problem), 3. mapping (recognizing the similarities and differences between two lower-order relations), 4. applying (transferring a previously inferred relation to a new domain), 5. comparing (comparing and contrasting any multiple answer options), 6. justifying (comparing the chosen answer option to one's perception of the ideal answer option, to determine whether the selected answer option is good enough), and 7. responding (providing an answer to the given problem).

Knowledge-acquisition components are processes used in acquiring new declarative and procedural knowledge and consist of selective encoding (used to distinguish relevant from irrelevant information); selective comparison (used to decide what stored

information is relevant for solving a problem); and selective combination (used to put together information that has been selectively encoded or selectively compared). Sternberg (1986) suggests certain relations among the three kinds of knowledge-acquisition components. First, selective encoding and selective comparison both involve discriminating relevant from irrelevant information while selective combination involves putting together information already selected as relevant. Second, selective encoding and selective combination both operate upon information stored in working memory whereas selective comparison operates upon information stored in long-term memory. Finally, whereas selective comparison and selective combination both operate upon information that is known in some sense, selective encoding operates upon information that is unknown. In sum, each pair of the three kinds of knowledge-acquisition processes shares something in common that the other kind of process does not share.

When an individual already possesses sufficient declarative and procedural knowledge to solve a problem, only the metacomponents and the performance components are needed to construct a problem solving strategy. In this case, an individual uses the metacomponents to select which performance components to use and the order in which to use them, while the performance components are used to do the work of actually solving the problem. However, if an individual does not yet possess sufficient declarative and/or procedural knowledge to solve the problem, the knowledge-acquisition components become involved. That is, the knowledge-acquisition components obtain new information which is then operated on by metacomponents to construct a problem solving strategy.

Sternberg (1985) analyzed the performance of children considered intellectually gifted and those considered intellectually retarded, and found that the gifted demonstrated superior metacomponential, performance, and knowledge-acquisition

skills. In particular, they were better able to selectively encode, combine, and compare, giving them greater insight into the solution of novel problems. Sternberg's results corroborated the results from Chi et al. (1982); Larkin et al. (1980); and Sternberg (1981) who found that skilled individuals spent relatively more time planning how to solve a problem and less time actually solving it. Again, this suggests that skilled individuals spend relatively more time on higher-order metacomponential processing and less time on lower-order componential processing. In another series of studies, Sternberg (1977, 1985); Sternberg and Downing (1982); Sternberg and Gardner (1983); and Sternberg and Nigro (1980) used a componential analysis to identify components involved in analogical reasoning tasks and found that inference of relations, mapping, and application were consistent sources of individual differences. In other verbal analogy tasks, Pellegrino and Glaser (1979) used a componential framework and found skill differences among individuals. Skilled individuals spent more time in encoding and inference processes, and less time in decision responses. Another finding was that skilled individuals provided a very precise explanation of the relationship among the terms of an analogy and why a given alternative would not fit. Boswell (1979) investigated figurative comprehension and its relationship to individual and age differences between high school students and senior adults. Boswell concluded that while both groups were able to make analogical comparisons, the adults showed more qualitative responses along both analytical and synthetic dimensions. In other words, high school students focused on a particular attribute or showed a preoccupation with analysis and definition of particular concepts, while adults unified the concepts into a relevant and novel meaning.

The literature has provided a conceptual framework and suggested elements and variables to be addressed in the development of a methodology that could be used to facilitate the identification and description of information processing components and

patterns during the interpretation of proverbs and in the construction of a figurative meaning. The Conceptual Base Theory represents one framework and to date is the most appropriate framework for analyzing the interpretive process during proverb interpretation. The Conceptual Base Theory describes proverb interpretation in terms of a sequence of cognitive processes that results in the construction of an abstract, generative, conceptual base that serves to relate events that are dissimilar on a literal level. The sequence consists of four phases: 1. the Problem Recognition Phase, 2. the Literal Transformation Phase, 3. the Figurative Phase, and 4. the Instantiation Phase. Of particular interest in this study was the identification and description of the information processing components involved in the resolution of the Figurative Phase. It is suggested that it is during this phase that elements of a proverb are desymbolized in a figurative way to realize a relation between the terms of a proverb which, in turn, is used to construct a conceptual base. It was expected that the processes involved in the Figurative Phase could be further broken down into elementary information processing components using a componential framework, particularly the performance components suggested by Tourangeau and Sternberg (1982). However, attempts to apply the componential framework suggested by Tourangeau and Sternberg (1982) to a sample of verbal protocols collected during a pilot study clearly indicated that despite its credibility and appeal, the sequence of components proposed in their componential framework was of limited usefulness since the components were not defined clearly enough, required a high level of inference, and the components were not appropriate to the task. For example, no student appeared to have used "mapping of higher-order relations". Thus, while their componential framework captured the overall essence of the students' cognitive processes, not all of the data from the verbal protocols could be clearly classified using the components of their classification scheme. Most important, however, was the theoretical consideration that the components suggested by

Tourangeau and Sternberg (1982) are themselves dependent upon the cognitive processes involved in the interpretive process. In a sense, their components did not seem "elementary enough" to account for the ways that students recognize relationships or discover connections in the task designed for this study. Thus, the problem of how to identify the information processing components involved in the Figurative Phase of the Conceptual Base Theory remained.

The Need for an Appropriate Classification Scheme

Research relevant to the identification of cognitive processes used during problem solving tasks was examined in an attempt to find a framework of analysis that would be appropriate to this investigation. This examination of the research revealed that while a variety of models have been developed in an attempt to identify elementary operations involved in problem solving (Posner & McLeod, 1982) none of the models were able to capture all aspects of the objectives of this study. This is a situation that seems endemic to figurative language research (Honeck, 1986). Consequently, the decision was made to develop a classification scheme tailored to accommodate the objectives, the material, the task, and the sample involved in this study.

There were two major concerns underlying this decision. First, there was a general concern that given the type of task and the material involved, that an existing framework developed using a different task and different materials might prove limiting and thus restrict the information that might be gained from the students' verbal protocols. Second, many of the models proposed in the research, including the model proposed by Tourangeau and Sternberg (1982), suggest a number of high inference components. The term inference refers to "...the process intervening between the objective behavior seen or heard, and the coding of this behavior" (Rosenshine, 1971, p. 19). It was believed that to be useful, a classification scheme of the cognitive

processes involved in the interpretation of proverbs must reveal, as much as possible, low inference components. Since the study is exploratory, it was decided that the best approach would be to develop a classification scheme using content analysis techniques. Therefore, it was decided to use students' verbal protocols to develop a classification scheme rather than to impose upon the protocols a classification scheme or a set of high inference components derived from previous research. According to Newell and Simon (1972) objective data analysis from verbal protocols is possible if categories and processes are determined from the data, rather than imposed on the data.

Protocol Analysis

Protocol analysis, using the think aloud technique has gained popularity in research on problem solving and the areas of application of this method appear to be increasing (Ericsson & Simon, 1984). While some forms of verbal reports require an individual to analyze the composition of the thought processes, thinking aloud only requires that individuals provide an account of what they are doing while working on a task. Individuals are encouraged to state what they are doing, what is being searched for, plans, and which aspects or relations of the task catch their attention. They are not permitted to theorize about their behaviour.

Ericsson and Simon (1984) suggest that individuals be trained before a study so that during the task they can think aloud in a conversational manner without time delay. The resulting verbal data are contained in a protocol which is a verbatim transcript of a tape recording of each subject's verbalization of his/her problem solving behaviours. The think aloud technique can be regarded as a very natural activity, which constitutes no more than the vocalization of the already present inner language, that is, the language covertly utilized by individuals to plan and organize their thinking.

However, the analysis of verbal protocols does not provide a complete description of the problem solving process. Dunker (1945), although a strong proponent of the think aloud method, warns that "a protocol is relatively reliable only for what it positively contains, but not for what it omits" (p. 11). Nonetheless, it is a method which permits the externalization of certain covert cognitive processes, and thereby provides an investigator with an initial tool.

Among the methods used in previous problem solving research, the think aloud procedure appeared to be the most promising method for the identification and description of the information processing components involved in the interpretation of proverbs. A summary of the advantages of the think aloud procedure which determined its selection as the most appropriate method for the present study is provided in the following paragraphs.

First, verbal protocols permit the derivation of data representing actual problem solving behaviours and not interpretations or theorizations about such behaviours. In this respect, the verbal protocols represent low inference data.

Second, the data in the form of verbal protocols, are closely related to the task. The delay between the occurrence of the problem solving behaviours and their being reported is minimal. Consequently, the danger of editing is considerably reduced. In addition, since the protocols are analyzed by the investigator for evidence of components and patterns of components, the subjects do not need to infer processes.

Third, the major advantages of verbal protocols generated using the think aloud method are that the procedure is relatively easy to learn and that it can be highly productive. As long as the subjects are willing to co-operate, if they understand that they are not only to work at a task but to verbalize what is in their minds while doing so, and if the data obtained from the verbal protocols are interpreted within a framework that accepts the limitations of the technique, then verbal protocols can

provide access to cognitive processes (Ericsson & Simon, 1984). A particular advantage is that details of a solution sequence are reflected: "Protocols provide us with a very valuable window onto our thought processes. Though the scope of that window is not infinite, it is wider than most of the other windows available" (Hayes & Flower, 1981, p. 18).

Problem Statement and Research Questions

Attempts to provide a formal description of the processes involved in the interpretation of proverbs have met with limited success. In addition, the nature of the interpretive process itself needs refinement. According to Honeck and Kibler (1984): "While analogy solution is probably involved, the precise nature of the solution remains something of a mystery...there is at present no way to characterize it formally" (p. 413). A methodology to identify and describe the components used by students to interpret proverbs is still lacking.

Among questions concerning the linguistic and cognitive aspects of proverb interpretation, two may be cited to provide a framework to this study and to serve as a catalyst for generating further questions: 1. Are there individual differences in information processing patterns during proverb interpretation? 2. Are individual differences in verbal reasoning ability reflected by information processing patterns identified during proverb interpretation? Verbal reasoning ability is a variable that is particularly appropriate in the present study since the Conceptual Base Theory suggests that analogical reasoning ability is a major factor affecting successful proverb interpretation and since verbal reasoning ability is often measured using analogy-type tasks. Thus, if students were grouped according to their analogic reasoning ability, given a proverb and a number of instances that more or less illustrate the figurative meaning of the proverb, and then asked to rank the instances from best to worst

according to how well each instance illustrates the meaning of the proverb, one would expect to find a relationship between the ranks generated by the students and their analogical reasoning ability. Based on results from information processing research, one could predict that the cognitive processing components could be hierarchically ordered in terms of their efficiency; that is, certain components would be more likely to be associated with a correct interpretation than would other components.

Various tasks have been employed in attempts to study proverb comprehension. Two conclusions to be drawn from these studies are that: 1. to state that someone understands a proverb can be operationalized in several different ways and 2. each of the operationalized definitions of proverb comprehension requires a different response mode which may also involve different complexities. The simplest of the comprehension tasks should be choosing a proverb as the advice for a short narrative. Honeck (1973), Honeck et al. (1975), Honeck et al. (1978) and Lemon (1938) demonstrated that increasingly rich context, of various types, facilitates comprehension. A story format not only provides a fully explicated concrete setting for a proverb, but it is also the natural setting for proverb use. A more difficult task is to request that an individual explain what a proverb means. Not only is there no context for the proverb but the results are questionable since investigating cognitive/linguistic skills by making demands on metacognitive/linguistic skills is not a very promising approach. For example, asking a student to explain the meaning of a proverb is a metalinguistic task and the response may lead one to underestimate the student's true comprehension. Another type of task, involving a multiple-choice format, may avoid the problems associated with the metalinguistic tasks, but may be confusing to a student because a literally correct alternative is often included without any directive that nonliteral or figurative interpretations are expected. Accordingly, a ranking task is proposed that incorporates the advantage of providing a context with

the challenge of identifying and comparing abstract relationships. It is expected that a ranking task which requires a student to recognize a figurative meaning will avoid the pitfalls of the other types of tasks yet facilitate the identification of information processing components. Factors which relate to correctly sequencing or ranking instances within a given proverb set include: a) the ability to recognize similarities and differences between a proverb and an instance; b) the ability to recognize a figurative relationship between a proverb and an instance; c) the ability to apply an inferred figurative relation across different instances; and d) the selection of efficient and appropriate problem solving strategies. Further, the problem solving task could be decomposed into information processing components so that a student's ability to encode, analyze, and monitor strategies could be examined. The identification and description of information processing patterns associated with students of high and low verbal reasoning ability could be accomplished through the identification of information processing components arrived at through the analysis of verbal protocols collected during the ranking task. Such an analysis would also reveal the guiding principle used by a student to rank the sentences.

While there are a number of independent variables that may be related to the information processing components involved in the interpretation of proverbs, two variables were of concern in the present study - verbal reasoning ability and gender. Verbal reasoning ability is a variable that could be related to the interpretive process and it is the variable of primary concern in the present study. In addition, since little information could be found in the literature concerning the relationship of gender to the interpretation of proverbs, gender was used as a control variable. Consequently, verbal reasoning ability, and gender are independent variables that will be considered.

The research study is exploratory and primarily qualitative in nature. Although no formal hypotheses are stated, a number of research questions are raised that focus on

the cognitive processes used by students to construct a meaningful interpretation of a proverb. Formulations of research questions, rather than conventional hypotheses construction, were chosen because of the lack of prior research in the area of proverb interpretation. Four major research questions were addressed and discussed separately in this study. Specifically, the central question investigated in this study is:

> **Research Question 1** What are the information processing components used by a sample of grade nine students during the figurative interpretation of a proverb?

This question implies that students themselves might provide information about the cognitive processes they employ during their attempts to interpret the figurative meaning of proverbs.

Previous research has proposed broad sequences of cognitive events during the interpretation of figurative language but, at this time, there is no research that attempts to identify, in terms of information processing components, the cognitive processes involved in the interpretation of figurative language in general and proverbs in particular.

The answer to this question provides a source of information for further scrutiny. Supplementary questions include:

> **Research Question 2** Is the negotiation of the four phase sequence proposed in the Conceptual Base Theory a prerequisite for the correct interpretation of a proverb?

This question focuses on the appropriateness of the Conceptual Base Theory as a model for understanding the interpretation of proverbs.

> **Research Question 3** Is there an association between the observed information processing patterns demonstrated by the grade nine students and the independent variables of gender and verbal reasoning ability?

This question focuses on the frequency of component use by the sample. Once the elementary information processing components are identified, it is important to determine differences as well as similarities in the use of these components in terms of patterns.

Research Question 4 Is the construction of a four-term analogy a necessary and sufficient condition for the correct interpretation of a proverb?

While much of the research suggests that the construction of a four-term analogy is required for figurative interpretation, there is little direct evidence to support this claim. Often, this suggestion is prompted by referring to correlational studies which compare scores on analogical reasoning tasks with scores on figurative language tasks and infer a causal relationship. This question serves to narrow the focus to the interpretation of proverbs and to provide direct evidence using protocol analysis.

The aim of this study is to pursue an exploratory approach within an information processing framework to identify and describe the information processing components involved in the interpretation of proverbs. Verbal protocols will provide the basis for the development of a classification scheme that will be used to identify and describe these components. The Conceptual Base Theory has provided a theoretical framework to account for the interpretive process; however, it provides global characteristics which need to be refined so that the dynamics involved in the interpretive process, particularly during the Figurative Phase, can be understood more clearly. In this respect, the questions addressed in this study extend those raised by the Conceptual Base Theory.

The following chapter describes the design of the study and the development of the methodology used to identify and describe the information processing components involved in the construction of a meaningful interpretation of a proverb.

Chapter 3

RESEARCH METHODOLOGY

This chapter provides a description of the population, sample, task, and procedure used in the study. In addition, it provides additional support for using verbal protocols as data and describes the data collection procedure as well as the data analysis methods. However, the highlight of this chapter is the description of a classification scheme to identify and describe the information processing components involved in the construction of a figurative meaning to a proverb through the analysis of the students' verbal protocols. The sample, the proverb material, the task, and the framework used for data analysis were selected to be representative and practical. A closer look at each will give an indication of how well the issues mentioned above have been resolved and how well the interpretive process has been brought into focus.

Three of the many issues confronting anyone attempting to identify and describe the information processing components involved in the interpretation of proverbs concern the selection of the sample, the selection of the proverb material, and the selection of the task. First, if the sample consists of individuals too similar in background and abilities, there may be little chance of observing a wide range in patterns of thinking and if the sample consists of adults, the results may not be applicable to students at the secondary level. Second, if the proverb material is familiar or known, there may be little chance of observing the interpretive process. The interpretive process is observable only to the extent that it is executed in controlled, rather than automatized, fashion. Accordingly, the proverb material should be novel to increase the chance of externalizing the interpretive process. Third,

the task must be designed in such a way that it captures the interpretive process. It must exploit the interaction between the student and the proverb material to produce data that reflect the interpretive process so that information processing components can be identified, described, and explained. The method of thinking aloud can be used to capture the interaction and has the virtues of being productive and easy to use. If the student understands what is wanted, that is, that he/she is not only to complete the task but also to tell how he/she does it, then one can obtain detailed information, in the form of verbal protocols, reflecting the interpretive process. In this sense, a student's verbal protocols act as indices of information processing components that permit one to trace the interpretive process.

In a review of empirical studies, Ericsson and Simon (1984) address two important questions concerning the use of verbal protocols. First, do verbal protocols reflect underlying thought processes accurately? Second, does having to produce verbal protocols significantly change or distort normal thinking? In response to the first question, they maintain that accuracy is highest if the verbal protocol is concurrent rather than retrospective or introspective, if prompting is kept to a minimum, and if the solution process is executed in controlled, rather than automatized, fashion. As to the second question, Ericsson and Simon (1984) have compared the performance of subjects with and without concurrent protocol production, and concluded that in most cases, performance is not significantly changed by having to produce a verbal protocol. Verbal protocols are used in an attempt to gain insight into the thought processes of individuals during problem solving (Ericsson & Simon, 1984; Hayes & Flower, 1980; Newell & Simon, 1972). Verbal protocol collection and analysis followed the guidelines of Ericsson and Simon (1984). The taped verbalizations for each Proverb Set were transcribed verbatim and the response time recorded. The response time is the time from the first reading of the proverb to the time the final rank is given for that

proverb set. The three proverb sets yielded 240 verbal protocols. Clearly what was needed was not only a method to capture the interpretive process, but also a framework or coding scheme to classify, to describe, and to explain the data.

Population

Grade 9 students from a semi-rural population that one is likely to encounter across the province of Ontario were selected for this study for the following reasons: 1. they are confronted with a variety of figurative material in their reading and must construct a meaningful figurative interpretation to comprehend what is read; 2. they have not received direct instruction in interpreting proverbs so there is a greater probability that their interpretive process will be executed in a controlled rather than automatized fashion; and 3. the availability of recent psychometric testing provided an appropriate method for grouping students according to their analogical reasoning ability; accordingly, students could be expected to display a wide range of analogical reasoning and ability.

Sample

The sample consisted of 40 males and 40 females who were enrolled in the ninth grade at a local high school. The students ranged in age from 14 years 1 month to 16 years 1 month, with a mean age of 14 years 8 months.

Two variables were considered with respect to the selection of the sample: gender and verbal analogical reasoning ability. Gender was of interest since the literature on figurative language contains few studies in which gender differences are examined and these studies typically have college students or adults as subjects. No one, apparently, has studied gender differences as they relate to the interpretation of figurative language. Verbal analogical reasoning was of interest for two main reasons. First, the

construction of an analogy format to understand conceptually disparate items is often suggested to be an integral part of figurative understanding and it is also a major feature of the Conceptual Base Theory of proverb comprehension (Honeck et al., 1980). Second, this ability is a mixture of verbal ability and abstracting both of which are involved in the comprehension and interpretation of figurative language in general and proverbs in particular. Thus it was considered prudent to have an appropriate measure of the students' analogical reasoning ability. The Verbal Reasoning subtest of the Differential Aptitude Test, Form V (Bennet, Seashore, & Wesman, 1982) is basically a test of analogical reasoning that is well documented and has high predictive and construct validity and reliability ratings. Further, the designers of the Differential Aptitude Test have made an effort to ensure that the Verbal Reasoning subtest measures a student's ability to recognize relations among items rather than vocabulary knowledge.

The global median was computed from the Verbal Reasoning subtest scores of one hundred seventy-three grade nine students who had recently completed the Differential Aptitude Test, Form V. Four categories which reflected the variables of gender and analogical reasoning ability were formed from this median: 1. Male, high verbal reasoning; 2. Male, low verbal reasoning; 3. Female, high verbal reasoning; and 4. Female, low verbal reasoning. Twenty students were randomly selected that represented each of these four categories resulting in a sample size of eighty students. Because the process involved in data collection and analysis in qualitative types of research is both lengthy and time consuming, the sample size is often, of necessity restricted. Therefore, even though the sample size of eighty is large from a qualitative perspective it was deemed desirable to enable information processing components to be identified with a reasonable degree of stability and to facilitate a complementary quantitative analysis of the data.

Instruments

Information on the students' analogic and abstract reasoning abilities were available from the Differential Aptitude Test which had been administered to one hundred seventy-three grade nine students two months prior to the collection of the verbal protocols. From the 8 subtests that compose the Differential Aptitude Test, two subtests were of particular interest: 1. Verbal Reasoning, which is essentially a test of analogical reasoning presented in a multiple-choice format designed to measure a student's ability to manipulate ideas at an abstract level and to measure a student's ability to understand concepts in words and to reason with words; 2. Abstract Reasoning, which is a measure of a student's ability to understand ideas that are not expressed in words and to see relationships among objects. The Abstract Reasoning subtest is essentially a nonverbal measure of a student's reasoning ability. The split-half reliability coefficient for each of these subtests for males and females in grade 9 ranges from .91 to .94 respectively.

Scores from the Verbal Reasoning subtest of the Differential Aptitude Test were used to group students. Scores from the Abstract Reasoning subtest were also considered because of the focus on a student's ability to understand concepts and to see relationships among objects. The group means and standard deviations for these subtests are presented in Table 1. It can be noted in Table 1 that the abstract reasoning scores between the high verbal reasoning and low verbal reasoning groups are closer than those with the verbal reasoning scores. On verbal reasoning scores, the low groups are more homogeneous (SD = 2.70 & 2.78) than the high groups (SD = 5.42 & 5.58) which is typical for extreme groups selected from a positively skewed distribution. The same trend is not observed with the abstract reasoning scores. Thus, for purposes of comparison, the groups have the characteristics, in terms of the discrepancy between high and low verbal reasoning ability, that were desired.

Table 1.

Verbal and Abstract Reasoning Ability Across the Four Groups

Verbal Reasoning	Gender	Reasoning Ability Score			
		Verbal		Abstract	
		M	SD	M	SD
High	M*	29.65	5.58	34.25	8.46
(n=40)	F	28.95	5.42	35.35	4.36
Low	M	11.95	2.70	27.05	8.24
(n=40)	F	14.40	2.78	28.55	7.42

*Note. Each of the four groups consists of twenty students.

The proverb material used in the present study consisted of 27 sentences that constituted 3 proverb sets of 9 sentences each. Each proverb set contained one proverb, one abstract sentence that was an excellent interpretation of the proverb's figurative meaning, one abstract sentence that was a poor or irrelevant interpretation of the proverb's figurative meaning and six concrete sentences that were more or less related to the proverb's figurative meaning. The excellent (best) and irrelevant (worst) interpretations were general, abstract statements, in contrast to the 6 concrete sentences. All 27 sentences grouped into proverb sets are presented in Table 2. Each student was asked to rank each of the eight sentences in a given proverb set according to how well each sentence illustrated the meaning of the proverb. Two correct identifications were of particular interest: the correct identification of the abstract figurative meaning and the correct identification of the abstract sentence that was irrelevant to the proverb. Each received one count resulting in a category score of either 0, 1, or 2 per proverb set.

The proverb sets were adapted from previous research using proverbs (Honeck et al., 1985). The adaptation was minimal and consisted in reducing the number of sentences in each proverb set from 13 to 9. The reduction in the task demand was prompted by a concern, considering the age of the students, that if a proverb set were too lengthy it might interfere with a student's performance on the subsequent proverb sets. The proverb sets contained no rhyming and used simple vocabulary and regular English phrase structure. The proverbs themselves were unfamiliar to the students, had regular structure, and were semantically non-deviant. Although unfamiliar, the students required no special knowledge to understand the proverb's literal or figurative meaning and the literal and figurative meanings did not overlap.

The six concrete sentences or instances associated with each proverb had been constructed to describe situations whose meanings varied in terms of how well they

Table 2.

Proverb Sets

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1. A NET WITH A HOLE IN IT WON'T CATCH ANY FISH.

   A proper but faulty instrument won't help you achieve your goal.
   The gifts that nature gives us cannot be taken lightly.
   The missionary who did not speak the natives' language converted no one.
   The ugly sofa couldn't be sold.
   The spy couldn't figure out the coded message.
   The sleeping security guard didn't hear the thieves.
   The fireman's suit didn't protect him from the high temperature.
   The small pump was used to inflate the truck's tire.

2. BEES HAVE HONEY IN THEIR MOUTHS AND STINGERS IN THEIR TAILS.

   Some things that look good on the surface may turn out to be totally bad.
   A part of a whole doesn't necessarily fit all contexts or wholes.
   The psychopathic killer wined and dined his victims before letting his motives be known.
   The summer raindrops were so heavy, they cracked the parched crops.
   The loan shark was more than happy to give the indebted gambler $5,000 at 25% interest.
   The manipulative son complimented his mother on her new hair style and then asked her if he could borrow the car.
   The seemingly playful pup took a chunk out of the boy's arm.
   The star batter saved the game by scoring the winning run, but broke the team's last bat.

3. THE MONKEY TAKES THE CHESTNUTS OUT OF THE FIRE WITH THE DOG'S PAW.

   People may use others for their own gain.
   Broken instruments don't have to be thrown away.
   The teenager talked his sister into crossing the thin ice.
   The older children had their youngest brother ask their bad-tempered father if they could go to the movies.
   The head scientist took all the credit for an award despite the fact that his assistants had all the bright ideas.
   The student paid the math major to take his calculus exam.
   The police lieutenant sent the rookie cop into the robber's hideout.
   The baseball players' batting average kept going down, so he blamed it on the manager.

Note. The 8 sentences in each proverb set are, respectively, the proverb, the abstract excellent interpretation, the abstract irrelevant (poor) interpretation, and the 6 concrete sentences.

illustrated the figurative meaning of the proverb. Some instances expressed situations that were entirely consistent with the proverb's figurative meaning, while others expressed situations that were irrelevant to, or only partially consistent with, the proverb's figurative meaning. In constructing the instances, Honeck et al. (1985) agreed on the essential semantic elements in each proverb and then generated instances that contained various combinations of these elements. Within each proverb set, repetition of content words and of the semantic domain of the sentences was avoided. Each sentence in a proverb set, except the abstract irrelevant sentence, contains elements that could be compared to elements in the proverb to construct a four-term analogy to determine the degree of the figurative relationship.

Procedure

The purpose and nature of the study was explained to the entire grade 9 student body during an informal assembly and to each student's parent(s) in a letter. It was emphasized that a student's participation in the study was voluntary, that the time commitment was a maximum of one hour, that information obtained would be confidential, that a student could withdraw from the study at any time, and that participation in, or withdrawal from, the study would in no way affect the student's academic grade. Consent forms were sent to the parents of the one hundred seventy-three students who had completed the Differential Aptitude Test and a stratified random sample was drawn from the pool of students (N=151) whose parents granted permission to participate.

A pilot study was conducted prior to the present investigation with grade 9 students attending a different high school within the same school board. This was done to identify potential difficulties with the proverb sets such as the appropriateness of the vocabulary and syntax since a proverb can be made arbitrarily difficult by using

vocabulary or phrasing that is difficult to encode. The pilot study also provided the researcher with additional experience at collecting verbal protocols.

The eighty students that comprised the stratified random sampling selected from the one hundred fifty one grade nine students were seen individually in a private room at their own school. The purpose and nature of the study were again explained to each student at the beginning of a session. Each student was encouraged to do all of his/her thinking aloud, and to say what he/she was thinking as he/she worked. To help each student understand the think aloud method, a taped example of a student using the think aloud method while solving a simple arithmetic word problem was presented. Then, each student was given two simple arithmetic word problems to practise the think aloud technique. When the student appeared comfortable with the think aloud technique, the researcher reiterated that the purpose of the study was to learn more about how students solve problems and that the study was not intended to make an individual diagnosis or evaluation.

The student was then given a laminated, 4″ by 6″ typed card containing one of the three proverbs. To avoid influencing the student's performance on the task the word proverb was not used in the instruction to the student; rather, Proverb 1 was referred to as Statement 1, Proverb 2 was referred to as Statement 2, and Proverb 3 was referred to as Statement 3. The student was asked to read the proverb aloud and to think about its meaning. Next, eight, 4″ by 6″ laminated cards corresponding to the proverb were placed in front of the student in two columns with four cards in each column. A random selection procedure was used to determine the order in which the cards for each proverb set were to be arranged in front of the student. Once determined, this order remained constant. On each card was typed a sentence which more or less illustrated the figurative meaning of its corresponding proverb. Students were asked to rank the eight sentences according to how well each sentence illustrated

the underlying meaning of the proverb, to think aloud, and to explain each choice verbally. Each student was required to arrange the eight cards so that the card with the sentence that the student felt was the best interpretation was first and the card with the sentence that the student felt was the worst interpretation was last. The instruction was repeated or rephrased until the student demonstrated comprehension by telling the researcher the procedure for the task. This sequence was followed for the three proverb sets. Once on task, if a subject fell silent for ten seconds the researcher asked, "What are you thinking now?" or "Please tell me everything you are thinking," or a similar probe. To perform this task, a student would have to devise some criteria or develop some organizing principle which would guide his/her rankings. In other words, the students' task was to rank order the goodness of eight alternative sentences in terms of their appropriateness to a proverb. The three proverb sets yielded two hundred forty verbal protocols.

Development of the Classification Scheme

After each student's taped protocols were transcribed, the response time for ranking each proverb set calculated, and the best-worst pair for each proverb set scored, the verbal protocol for each proverb set was segmented into episodes so that the researcher could trace a student's process sequence during the ranking task for each proverb set. By examining the verbal protocols of students, the researcher was able to identify episodes corresponding to the four phase sequence of the Conceptual Base Theory as well as elementary information processing components involved in the resolution of the Figurative Phase which is the solution phase of the Conceptual Base Theory. Verbal protocols were also examined for information processing similarities and contrasts by comparing the protocols of correct responses on the same proverb set across students and groups, by comparing the incorrect responses on the same proverb

set across students and groups, and finally, by comparing the protocols of incorrect and correct responses across proverb sets, students, and groups. A student was considered to have successfully interpreted a proverb's figurative meaning if he/she correctly ranked both the best abstract instance and the worst/irrelevant abstract instance of a proverb set.

Episodes were defined as periods of time during which the student was engaged in a single set of like actions (Schoenfeld, 1985). Using this definition, episodes were identified as dealing with: 1. ENCODING; 2. ANALYZING; and 3. MONITORING. In addition a RESPONSE CATEGORY was created in which each best/worst rank was categorized as either figurative or literal. There is a correspondence between the episodes identified in the verbal protocols and the phases of the Conceptual Base Theory. The ENCODING episode corresponds to the Problem Recognition phase and the Literal Transformation phase while the ANALYZING episode and RESPONSE CATEGORY episode correspond to the Figurative and Instantiation phases respectively of the Conceptual Base Theory. The MONITORING episode was included to determine if students provided themselves with feedback on their progress and if they used this feedback to alter their ranks. Next, information processing components for each episode were identified with a particular focus on the ANALYZING episode since it corresponds to the Figurative Phase. The researcher examined the protocols for information processing similarities and contrasts by comparing the protocols of the students according to the gender and verbal reasoning groupings as well as the scores received for the ranking of the best-worst pairs. For logistic reasons, the first 168 proverb sets (3 proverb sets for 56 students) transcribed from the total 240 proverb sets were used to identify and define distinct information processing components for analysis of verbal protocols obtained during the ranking task. These were protocols taken from fourteen students in each of the four verbal

reasoning groups. Fifteen information processing components were identified across the four episodes. The resultant classification scheme is presented in Table 3. To better understand the classification scheme, examples of verbal protocols matching the codes used to represent the information processing components as well as the response categories are presented in Appendix A.

After the entire 240 verbal protocols (3 proverb sets for 80 students) had been coded, the coded protocols were set aside for three weeks. Then the researcher used the definitions to recode 50% (120) of the protocols (3 proverb sets for 40 students with 10 students selected at random from each of the four student groupings). Five protocols were recoded differently; therefore, 95.83% of the codes were in agreement with the previous coding. As well, a measure of intercoder reliability was determined to provide an index of the reliability of the classification scheme. Three school teachers were trained to apply the classification scheme to a number of verbal protocols obtained in the pilot study. Subsequent to this orientation session, the three teachers coded the verbal protocols of a stratified random sampling of twelve students representing 3 students from each of the 4 verbal ability and gender groupings. Then, the codings obtained by the researcher were compared with those obtained by the three teachers.

Of the 288 coding decisions made by each coder, that is, 8 sentences for each of 3 proverb sets for 12 students contained in the stratified random sampling, 259 coding decisions were identical. In other words, using the classification scheme developed for this study, the four coders agreed on their decisions a total of 89.93% of the time.

Table 3.

Classification Scheme with Corresponding Phases of the Conceptual Base Theory

Episode	Component	Code	Definition
ENCODING Problem Recognition Phase	Reads Material	RM	Student reads material. Includes re-reading(s) of material. Material is translated into an internal representation for further interpretation. Involves perceiving the sentence and accessing stored information that enables student to translate the material.
Literal Transformation Phase	Relevant Information	RI	Student uses relevant/irrelevant semantic/syntactic information in a sentence or proverb. This information is used to compare instance elements with proverb elements.
ANALYZING Figurative Phase	Analogy Construction	AC	Student uses sentence elements to construct a four-term analogy (A:B::C:D).
	Key Word	KW	Student's reasoning is developed around a single word; consequently, sentence rank is based on a single word.
	Element Comparison	EC	Student compares and relates elements from one sentence to elements in proverb or in other sentences to determine rank.
	Conceptual Figurative	CF	Student identifies abstract relation and infers figurative meaning from proverb to determine rank. Student integrates information across sentences to infer a common underlying theme.
	Forced Match	FM	Student forces a match between a sentence and a proverb to determine sentence rank.
	Surface Processing	SP	Student determines rank using literal information/elements only.
	Personalizes Elements	PE	Student personalizes information and comments on sentence elements to determine rank. Student interprets proverb and sentences in isolation according to his/her experience.
MONITORING	Checks Rank	CR	Student checks a sentence's rank for goodness of fit during task.
	Alters Rank	AR	Student alters a sentence's rank after checking.
	Rank Not Checked	NC	Student does not check rank.
RESPONSE CATEGORY Instantiation Phase	Figurative Conceptual	FC	Student's response demonstrates a figurative understanding; there is evidence of a figurative understanding and the construction of a conceptual base.
	Literal Perceptual	LP	Student's response demonstrates a literal understanding only; the sentence has been determined using perceptual features only.
	No Match	NM	Student does not make a match between a sentence and a proverb. Student ranks irrelevant, abstract sentence last.

Data Analysis

Descriptive, qualitative, and quantitative analyses were performed on the data collected for the study, the latter involving non-parametric techniques. The Statistical Analysis System (SAS) was used for the preliminary analysis of data. The following information was entered into a data file for each student: the student identification code; the age of the student; the student's gender; the student's Verbal Reasoning Score; the student's Verbal Reasoning Category (i.e. low or high); the student's Abstract Reasoning Score; the order in which the proverb sets were presented to the student; and a best-worst category score. In addition to this background information, the following information was entered for each sentence ranked: the processing codes for each episode for each proverb set; a category code to identify if the response was figurative or literal; and the response time. This provided the opportunity to analyze the data across a variety of levels, including 1. the individual sentence, 2. the individual student, and 3. the groups.

The number of correct best-worst pair responses and the response times were determined for each individual and, subsequently, for each group across the 3 proverb sets. The means and standard deviations of these scores were computed for the four groups across the three proverb sets. An analysis of variance (ANOVA) was used to determine if there were significant differences between the means of the groups on category scores and response times. The frequencies of components for each proverb set were determined according to verbal reasoning ability and gender groupings. For each proverb set, the frequency distribution of components was determined by the number of observations; for example, the eight sentences to be ranked would provide 8 times 20 (individuals per verbal reasoning/gender grouping) or 160 observations. Since there were three proverb sets, there was a total of 480 observations (160 per proverb set times 3 proverb sets). Determining the frequency distribution of components facilitated the identification of information processing patterns.

By analyzing the ranks for each proverb set, individual frequency distributions of information processing components were constructed for each student group. Of particular interest were the information processing components associated with the best-worst pair ranking for each proverb set.

The presentation and interpretation of the results obtained from this study follow in Chapter 4.

Chapter 4

PRESENTATION AND INTERPRETATION OF RESULTS

In this chapter one finds a presentation of the results obtained during this study. However, before proceeding a synopsis of the salient features of the study is provided as a background for the results.

Background Information

The 80 students who participated in this study attended grade 9 at a local high school. The students ranged in age from 14 years 1 month to 16 years 1 month, with a mean age of 14 years 9 months. Two variables were considered with respect to the selection of the sample: verbal reasoning ability and gender. Thus, four groups of 20 students each, which reflected the variables of gender and verbal reasoning ability were formed: 1. Male, low verbal reasoning (ML); 2. Female, low verbal reasoning (FL); 3. Male, high verbal reasoning (MH); and 4. Female, high verbal reasoning (FH).

The students were seen individually in a private room at their school. The researcher emphasized to each student that the purpose of the study was to learn more about how students solve problems and that the purpose of the study was not to diagnose or evaluate. The students were told that there was a general underlying theme in each set of instances presented to them and that they should rank each instance according to how well it illustrated this idea. The student's task was to rank order, from best to worst, the goodness of eight alternative sentences (instances) in terms of how well each sentence reflected the meaning of a given proverb. Two correct identifications were of particular interest: the correct identification of the

proverb's abstract figurative meaning (i.e this sentence should be ranked as 1) and the correct identification of the abstract sentence that was irrelevant to the proverb (i.e. this sentence should be ranked as 8). Each received one count resulting in a category score of either 0, 1, or 2 per proverb set. Students were encouraged to do all their thinking aloud, that is, to say what they were thinking while they worked through the task and to justify, concurrently, each ranking decision. This procedure yielded data in the form of verbal protocols which were used as the basis for the development of a classification scheme to identify information processing components involved during the task.

The verbal protocols were coded using the tape-recording and its transcription concurrently. It was found that the recording revealed nuances not captured in a transcription alone. Each student's progress through the ranking task was coded on a coding form (Appendix L). A total of 240 completed forms resulted since each of the 80 students ranked 3 proverb sets. Categories from the coding forms were then tabulated and counted for each student for all proverb sets and across the four groups.

Intragroup Consensus

Since one of the variables used to group the students was verbal reasoning ability, it was decided to compute a measure of intragroup consensus. This decision was based on the premise that to the extent that the students within a group were using similar criteria to guide their rankings then agreement should have been high.

Kendall's W statistic, the Coefficient of Concordance (Siegel, 1956) was used to assess intragroup agreement based on sequences of 8 ranks obtained from the ranking of 8 sentences consisting of 2 abstract and 6 concrete sentences. The 6 concrete sentences were closer in meaning resulting in greater heterogeneity in ranking. For each group, three Ws were calculated, one for each proverb set. As indicated in Table

4, the Ws are in general higher for the high verbal reasoning groups. This is particularly true for the Net and Monkey proverb sets where the Ws range from .13 to .24 for the low groups and from .29 to .53 for the high groups. However, the Bees proverb set does not discriminate between the low and high verbal reasoning groups. Interestingly, the group Ws for the proverb set Bees have honey in their mouths and stingers in their tails, appear to align themselves according to gender rather than verbal reasoning scores as in the other two proverb sets. These data suggest that none of the groups used the same principle or abstracted a common underlying theme to guide their rankings. One would have expected that the high verbal reasoning groups would be able to identify the general underlying theme and use this theme to guide their rankings. In such a situation, agreement on the rankings of these two groups would have been high which would have resulted in a higher W. The intragroup results do suggest, however, that the low verbal reasoning groups used more idiosyncratic criteria to guide their rankings than the high verbal reasoning groups.

Distribution of Best-Worst Pair Scores

Each student was asked to rank each of the eight sentences in each of the three proverb sets according to how well each sentence illustrated the meaning of its corresponding proverb. The distribution of these category scores for the three proverb sets, according to verbal reasoning ability and gender, as well as the total score for each group are presented in Table 5.

Table 5 indicates that students had less difficulty identifying the abstract correct and the abstract irrelevant sentence associated with the proverb The monkey takes the chestnuts out of the fire with the dog's paw. The MH and FH verbal reasoning groups' category scores indicate that they were better able, compared to the ML and FL verbal reasoning groups, to recognize the abstract figurative meaning represented by the

Table 4.

Coefficients of Concordance by Group and Proverb Set

Group	Statistic	Proverb Set		
		Net	Bees	Monkey
Male, low verbal reasoning	W	.13*	.17**	.19**
	x^2	18.76	24.24	26.41
Female, low verbal reasoning	W	.20**	.25**	.24**
	x^2	28.58	35.01	33.51
Male, high verbal reasoning	W	.46**	.16**	.50**
	x^2	64.21	22.99	69.91
Female, high verbal reasoning	W	.29**	.25**	.53**
	x^2	40.16	34.78	73.89

*$p \leq .01$ and **$p \leq .001$ on the basis of the null hypothesis H_0: $W = 0$.

Table 5.

Distribution of Category Scores for Proverb Sets by Gender and Verbal Reasoning Category

Gender	Verbal Reasoning	Category Score	Proverb Set: Net	Bees	Monkey	Total
Male	Low	0	13	13	8	
(n=40)		1	5	4	9	34
		2	2	3	3	
	High	0	5	7	0	
		1	11	8	9	68
		2	4	5	11	
Female	Low	0	10	8	4	
(n=40)		1	8	7	9	52
		2	2	5	7	
	High	0	9	7	1	
		1	8	9	6	63
		2	3	4	13	

Note. Best-worst category score:

0 = incorrectly ranks best-worst pair
1 = correctly ranks only one of best-worst pairs
2 = correctly ranks best-worst pair

sentence "People may use others for their own gain" and the abstract sentence that was irrelevant to the proverb represented by the sentence "Broken instruments don't have to be thrown away". However, the ML and FL verbal reasoning groups performed better on the ranking task associated with this particular proverb than they did on the ranking tasks associated with the other two proverbs.

Since the proverb sets were presented in counterbalanced order, it is unlikely that the higher scores for this proverb set can be attributed to any practise effect. However, it could be argued that the proverb The monkey takes the chestnuts out of the fire with the dog's paw is event-specific, and that this facilitated the construction of a concrete representation that in turn was best expressed in the sentence "People may use others for their own gain".

In Table 5 the interpretation of the category scores of 0 and 2 is fairly straightforward since the scores indicate, respectively, that either a student did not correctly rank either the best abstract sentence or the worst abstract sentence of the best-worst pair or that a student did correctly rank the best abstract sentence and the worst abstract sentence in the best-worst pair. However, since a student could obtain a category score of 1 by correctly ranking only one of the best-worst pair, it is necessary to analyze the distribution of the category 1 scores.

With reference again to Table 5, it can be observed that the distribution of category 1 scores for the ML verbal reasoning group, MH verbal reasoning group, FL verbal reasoning group, and FH verbal reasoning group for the proverb set, A net with a hole in it won't catch any fish, is 5, 11, 8, and 8 respectively. As a proportion of these scores, the best-worst distribution is 3-2, 8-3, 5-3, and 2-6 respectively. For the proverb set, Bees have honey in their mouths and stingers in their tails, the distribution of category 1 scores for the four groups is 4, 8, 7, and 9 respectively. For this proverb set, the best-worst distribution as a proportion of the category 1 scores is 1-3, 3-5, 1-6,

and 4-5 respectively. For the proverb set, The monkey takes the chestnuts out of the fire with the dog's paw, the distribution of category 1 scores for the four groups is 9, 9, 9, and 6 respectively. For this proverb set, the best-worst distribution as a proportion of the category 1 scores is 0-9, 1-8, 1-8, and 0-6 respectively.

In the proverb set, A net with a hole in it won't catch any fish, the category 1 scores consisted of a greater proportion of best to worst identifications except for the FH verbal reasoning group, while in the proverb sets, Bees have honey in their mouths and stingers in their tails, and The monkey takes the chestnuts out of the fire with the dog's paw, the category 1 scores consistently consisted of a greater proportion of worst to best identifications. It is possible that for the proverb set A net with a hole in won't catch any fish, the students in 3 of the 4 groups chose the best abstract sentence "A proper but faulty instrument won't help you achieve your goal" because both the proverb and the sentence contained the word "won't". Thus, the students could have relied on a semantic match to decide the rank. In fact, the analysis of the verbal protocols of the three groups who chose the best abstract sentence for this particular proverb set reveals that these groups tended to use individual words to determine their ranking preferences, while the group whose category 1 score consisted of a higher proportion of worst to best identification (i.e. FH verbal reasoning) did not rely as often on this particular strategy.

For the proverb set The monkey takes the chestnuts out of the fire with the dog's paw the category 1 scores for the four groups are overloaded in terms of a worst to best proportion. That the four groups could correctly identify the abstract sentence that is irrelevant to the proverb suggests that the students could recognize something that doesn't fit even if they had difficulty recognizing the something that does fit. Thus it would appear that the four groups were able to employ a cancellation process that was used to determine the ranking of this sentence. An examination of the verbal

protocols revealed a tendency for students to try to recognize the irrelevant sentence first before trying to recognize the best sentence. This would suggest that a cancellation process as well as a construction process was at work. In any categorization or classification type of task, recognizing those items that do not represent category membership. This could suggest that students who could correctly identify the abstract sentence that is irrelevant to a proverb may employ a cancellation approach to understanding rather than construct a meaning.

Response Times and Category Scores

Students were not under time constraints to complete the ranking tasks associated with each proverb set required in the present study. Consequently, the time taken to complete the ranking tasks differed among individual students (Appendices C and D). The means and standard deviations of the response times and the category scores for the four groups are provided in Appendices E and F.

Students were selected at random from their respective independent populations. The category score variances are homogeneous (F_{max} = 1.68) while the response time variances are not (F_{max} = 3.71). However, the use of ANOVA design is not jeopardized for the design is robust with equal sample sizes. The chi-square goodness of fit test, when applied to both response time and category score distributions, indicated that there was no departure from normality (see Table 6). Consequently, the two-way ANOVA design is appropriate to apply to the data in Appendix E. There was no significant effect for gender and verbal reasoning ability on the dependent variable of time taken to complete the task. However, the ANOVA yielded a significant verbal reasoning ability effect on the dependent variable of the category score achieved on the task (p = .0002). The effect of gender on category score was not significant (p = .2669).

Table 6.

Analysis of Variance for the Variables Time and Category Score

Source	df	SS	F	p
Time				
Gender	1	202105.51	2.21	.1415
Verbal Reasoning Category	1	143905.61	1.57	.2138
Gender X Verbal Reasoning Category	1	6107.51	.07	.7969
Residual	76	6958537.25		
Category Score				
Gender	1	2.11	1.25	.2669
Verbal Reasoning Category	1	25.31	14.99	.0002
Gender X Verbal Reasoning Category	1	6.61	3.92	.0515
Residual	76	128.35		

Note. For the time variable, F_{max} = 3.71 and for the category score variable, F_{max} = 1.68 where the critical F_{max} (0.05, 4, 19) equals 3.44.

Goodness of fit

Time variable: x^2 = 11.256, df = 9, p > 0.05, class width = 100

Score variable: x^2 = 1.496, df = 4, p > 0.05, class width = 1

The ranking task associated with the proverb Bees have honey in their mouths and stingers in their tails was found to be more difficult than the ranking tasks associated with the other two proverb sets; that is, the ranking task required a greater amount of time to complete. Individual response times across the three proverb sets ranged from 345 seconds (FH) to 2,208 seconds (ML). Individual response times per proverb set ranged from 84 seconds (FH) (Monkey) to 807 seconds (ML) (Bees). The proverb set that received the highest category score, The monkey takes the chestnuts out of the fire with the dog's paw, required the least amount of time to complete.

While the groups' response times and category scores do provide valuable information in terms of group differences, they do not provide an adequate explanation of the information processes responsible for these differences in performance. There is, however, merit in identifying group differences when they are considered in conjunction with information processing characteristics contributing to these differences. The following section contains the results of the analysis of the students' verbal protocols to evaluate the Conceptual Base Theory.

The Process Sequence and the Conceptual Base Theory

Verbal protocols were used to identify group information processing characteristics while ranking the instances of each proverb set. According to the Conceptual Base Theory, the process of ranking instances of a proverb requires that an instance first be recognized as incongruent with the proverb at a literal level. Second, after this discrepancy is noted, the elements of an instance and a proverb are restructured into a format that facilitates their comparison using a variety of unspecified cognitive processes. The difficulty of the comparison is a function of the similarity of the instance and the proverb. Third, the result of this comparison is the development of a conceptual base that is used to resolve the initial incongruity by providing a common

meaning or microtheory that serves to link the instance with the proverb. Finally, this conceptual base is used to guide the ranking of other novel sentences so that if a sentence fits the category defined by the conceptual base, it becomes an instance of it. Theoretically, as a student is exposed to novel instances of a proverb, the conceptual base should undergo refinement. This process was confirmed by analyzing the protocols generated by those students who were able to correctly rank only the best abstract instance (Score 1), only the worst/irrelevant abstract instance (Score 1) or both the best and the worst abstract instances (Score 2).

Students identified as high verbal not only recognized the incongruity between an instance and a proverb at a literal level, but were more likely to restructure various elements in each in order to develop an appropriate conceptual base. By contrast, students identified as low verbal were less likely to go beyond the surface or literal elements to develop an appropriate conceptual base. These students tended to respond only to the concrete aspects of a proverb and an instance and restructured the elements into a concrete, literal format that, consequently, limited any comparisons to literal rather than figurative levels.

In general, it would appear that high verbal students were better able to use verbal ability and abstracting to recognize an implicit common meaning in a proverb and an instance than were low verbal students. A comparison of the distribution of category scores of MH and FH verbal reasoning students to the distribution of category scores of ML and FL verbal reasoning students would support this claim. As observed in Table 5, the MH and FH verbal reasoning groups have a greater proportion of category "2" scores than the ML and FL verbal reasoning groups except in one proverb set, Bees.

The number of students per verbal reasoning group and proverb set who successfully negotiated the four phases postulated by the Conceptual Base Theory is

presented in Table 7. Using protocol analysis and the definitions of the four phases comprising the Conceptual Base Theory, this completion table was constructed to trace the solution process of the students. It can be observed in Table 7 that of the 20 students in the ML verbal reasoning group, on the Monkey proverb set, only 12 were observed to reorganize the elements of an instance and a proverb into a format that permitted a comparison beyond a strictly literal level. Of these 12 students, 3 were observed to have developed a conceptual base that would link an instance to the proverb. However, it was also observed that the quality, and subsequent effectiveness, of a conceptual base varied among the students. For example, the category score distribution in Table 7 for the ML verbal reasoning group, on the Monkey proverb set, indicates that no students correctly ranked only the best, abstract instance, 9 students correctly ranked only the worst/irrelevant abstract instance, while only 3 students correctly ranked both the best abstract and the worst/irrelevant abstract instances. Thus, only the latter 3 students were considered to have demonstrated complete understanding of the proverb's figurative meaning and to have successfully negotiated the four phases of the Conceptual Base Theory since they were able to successfully construct and apply a conceptual base. More than one conceptual base may have been constructed, but only these 3 students developed a conceptual base that was abstract and generative enough to integrate the instances and the proverb even though they were dissimilar on a literal level. It is unlikely that without constructing a conceptual base, these students could correctly rank the best abstract and worst abstract instances.

Compare this to the solution sequence for the MH verbal reasoning group, on the Monkey proverb set. Their process sequence indicates that of the 20 students, 20 were observed to reorganize the elements of an instance and a proverb into a format that permitted a comparison beyond a literal level. Of these 20 students, 12 were observed

Table 7.

Completion Table Across Groups and Proverb Sets

Gender	Verbal Reasoning	Proverb Set	Conceptual Base Phases				Category Score Distribution[a]			Total Category[b] Score
			1	2	3	4	Best (only)	Worst (only)	Combination	
Male	Low	Net	20	7	5	2	3	2	2	9
Male	High		20	15	12	4	8	3	4	19
Female	Low		20	10	7	2	5	3	2	12
Female	High		20	11	5	3	2	6	3	14
		Bees								
Male	Low		20	7	4	3	1	3	3	10
Male	High		20	13	8	5	3	5	5	18
Female	Low		20	12	6	5	1	6	5	17
Female	High		20	13	8	4	4	5	4	17
		Monkey								
Male	Low		20	12	3	3	-	9	3	15
Male	High		20	20	12	11	1	8	11	31
Female	Low		20	16	8	7	1	8	7	23
Female	High		20	19	13	13	-	6	13	32

[a]Column totals are mutually exclusive

[b]Highest possible score = 40

to have developed a conceptual base and 11 students were observed to have developed an abstract and generative conceptual base which was then used by these 11 students to correctly rank the best abstract instance and the worst/irrelevant abstract instance.

In order to more clearly understand the process sequence, examples of verbal protocols corresponding to the four phases of the Conceptual Base Theory are presented. In the Problem Recognition Phase, the student recognizes the discrepancy between the proverb-as-literal-statement and an instance-as-literal-statement. Student 23, proverb set Net, offers a succinct assessment stating: "This doesn't make very much sense compared to that."

Recognizing that the proverb and instance do not match, at least at the literal levels, leads to the Literal Transformation Phase. In this phase, the student reorganizes, elaborates, and compares information in the proverb and an instance in an attempt to discover a relationship among elements in an instance that might be compatible with a relationship among elements in the proverb. Student 28, proverb set Bees, provides an example of this reorganization, elaboration, and comparison stating: "In a way it seems kinda similar because it's like bees, I don't know, they don't really give much of a hint to what they're gonna do and the killer, well, you can't really tell what he's gonna do 'cause he gives you dinner - he seems nice at first." In this phase, the student has gone beyond the literal elements of the proverb and the instance and tries to identify a relationship that is suggested by each and is, at the same time, common to both. Implicit in the protocol is the suggestion that the bees and the killer are both unpredictable. An additional example is provided by Student 61 who explains: "Well, it seems like the bees talk nice but they still can sting; and the pup seems playful but then he took a chunk out the boy's arm." Again, it can be observed how the student reorganizes elements, possibly elaborates upon elements (bees don't really talk) and compares elements from the proverb and the instance to identify a

shared relationship. Also, it was observed that the difficulty in comparing elements of a proverb and an instance seemed to be a function of their distance in terms of domains. From the protocols, it appeared that it was easier for students to recognize relationships when comparing animal to animal rather than animal to human. The protocols of Students 28 and 61 also revealed that an analogic format was used for the comparison process. The analogic format (A:B::C:D) was used by the students as a structure to compare the two contrasting ideas in the proverb as well as the instance. The protocol of Student 61 suggests the analogy, bees talk nice: but they still can sting::the pup seems playful:but then he took a chunk out of the boy's arm. This would tend to support the suggestion by Honeck et al. (1980) as well as Honeck and Kibler (1984) that an analogic format is used as a structural basis for comparison.

The comparison of the proverb and an instance inaugurates the Figurative Phase. The student who has successfully negotiated the first two phases has realized that the information in the proverb and an instance cannot be pattern matched on a literal basis. Since the proverb and an instance share a meaning that extends beyond the literal level, this shared meaning has to be abstract. Thus, the student has desymbolized the terms in the proverb and an instance to realize the relation between them. Accordingly, the problem (i.e. discrepancy) recognized in the Problem Recognition Phase and possibly represented in an analogy format in the Literal Transformation Phase was resolved in the Figurative Phase of the Conceptual Base Theory. An example of the resolution is provided by Student 37 who explains the common significance of the instances in the Bee proverb set. According to Student 37, "These two sentences have something good and something bad. Like, bees have a good part of them - like the honey - but then they also have the stingers, which is the bad part. Same as the pup. It looks cute and everything but then it bites the boy's arm." This student has resolved the initial discrepancy between the proverb and

instance by constructing a conceptual base that can be used to relate the instances and the proverb at an abstract level. Student 37 was able to recognize that the contrasting elements in the proverb and this instance were best captured by the instance "Some things that look good on the surface may turn out to be totally bad." This instance is abstract and generative in that it can be applied to other instances to determine the degree of similarity.

Once the problem has been resolved, the student moves into the Instantiation Phase. Here, the constructed conceptual base is applied to other instances to determine if an instance can be integrated due to a common meaning. An example of this application is found in the protocol of Student 63 who explains the order of her ranks. "They go like that because they're using these things - the people are using all of them for their own gain. Like the student, he's using the math major for his own gain to get a good mark, and like the head scientist is using the assistants for his own gain 'cause he's taking the credit." It would have been improbable that the student could provide a reasonable explanation for a particular rank without constructing a conceptual base. Without the conceptual base, it is unlikely that the common theme linking the instances would be recognized. The fact that the conceptual base could be applied to the instances suggests its abstract and generative nature. Students who did not construct a conceptual base were unable to identify the common significance shared by the proverb and the instances in a proverb set.

Thus, the verbal protocols generated by students during the ranking task provided an insight into the students' information processing patterns and provided a useful tool to evaluate the process sequence proposed in the Conceptual Base Theory (Honeck et al., 1980). Students who correctly ranked the best abstract instance and the worst/irrelevant abstract instance demonstrated, through their verbal protocols, that they progressed through a series of stages compatible to the phases of the Conceptual

Base Theory. These results suggest that the Conceptual Base Theory provides a valid framework for understanding the interpretive process involved in the interpretation of proverbs.

Application of the Classification Scheme

The results presented in the preceding section support the notion, at a macro level, that a four phase sequence similar to that proposed in the Conceptual Base Theory is involved in the interpretation of a proverb. The next step was to use protocol analysis to analyze, at a micro level, students' verbal protocols to identify the elementary information processing components involved in the resolution of the third, or Figurative Phase of the Conceptual Base Theory.

As can be noted in Table 3, the classification scheme consists of four episodes (ENCODING, ANALYZING, MONITORING, and RESPONSE CATEGORY) with each episode comprised of information processing components.

The episode labelled ENCODING encompasses those activities used by a student to represent the information contained in the proverbs and instances presented. As such, the ENCODING episode includes the information processing components identified as Reads Material and Relevant Information with the former component used 100% of the time by all of the students in the study. Such a high percentage is understandable considering that the students were instructed to read the proverb and the accompanying sentences. The component Reads Material is readily observable in the verbal protocols of the students and, consequently, it can be classified as a low inference component. However, the component Relevant Information could only be inferred from the students' subsequent ranks so it is classified as a high inference component. Nonetheless, a student's subsequent ranking of the sentences in a proverb set provided a reliable indication of whether or not the student was able to extract the

relevant abstract information shared by the proverb and the instances within a particular proverb set (see Table 7).

The episode labelled ANALYZING includes those elementary information processing components used by the students to determine the goodness of fit of an instance with a proverb. The seven components were identified as: Analogy Construction, Key Word, Element Comparison, Conceptual Figurative, Forced Match, Surface Processing, and Personalizes Elements. Unlike the phases in the Conceptual Base Theory, these components are not sequential and the use of one by two different students does not necessarily result in the same rank. Rather, the components represent the process observed to have been used by the students to determine if a proverb and an instance shared a common meaning and if this meaning, or conceptual base, could be applied to other instances in the proverb set.

The episode labelled MONITORING includes those components used by the students to monitor their progress through the ranking task. Monitoring one's decisions and progress during problem solving is an important component associated with high ability problem solvers (Peterson, 1988). This episode included the information processing components identified as Checks Rank, Alters Rank, and Rank Not Checked. Each proverb set consisted of eight sentences that had to be ranked. Since there were 3 proverb sets, this created the requirement for 24 ranking decisions. The 24 ranking decisions were to be made by 80 students which resulted in 1,920 total ranking decisions. Of the 1,920 total ranking decisions, 1,905 or 99.22% of the decisions were categorized under Rank Not Checked. While a number of reasons might account for such a high percentage, two possibilities are suggested. First, it could be that the design of the task did not encourage the students to check their responses although they were given every opportunity to do so. Second, the lack of solution monitoring is well documented in research on students' problem solving

abilities (Markman, 1985; Schoenfeld, 1985) so perhaps such a high percentage is not atypical and would tend to support earlier findings. Third, in the absence of a reference or guide in which one has confidence, it is often difficult to monitor one's progress. In this situation, to what criteria would one compare or evaluate progress?

Encoding and Monitoring are considered to be particularly relevant to successful problem solving (Sternberg, 1984). Often novices, or low ability problem solvers, interpret or represent problems using only literal features of a problem and neglect to monitor their progress. Conversely, experts or high ability problem solvers relate problems to principles or methods relevant for problem solution and during the solution process they consistently monitor their progress. As individuals develop expertise, they become more exhaustive in planning and solution monitoring and tend to consider all information presented rather than only a subset of information (Schoenfeld & Herrmann, 1982; Sternberg, 1985). Consequently, in contrast to novices, experts spend relatively more time on problem encoding and monitoring.

The episode RESPONSE CATEGORY was used to identify the extent of figurative or literal understanding. For instance, the frequency of correct identifications of the best abstract instance for each group across each proverb set was obtained: the potential total was 60 (20 students per group each ranking the correct abstract instance for 3 proverb sets). The results indicated that the high verbal reasoning groups had more figurative responses than the low verbal reasoning groups even though the percentage of figurative responses for both, 48.33% and 21.67% respectively, were low.

Table 8 provides a frequency distribution of the information processing components across the four groups and the three proverb sets. In addition to the identification of the 7 elementary information processing components: Analogy Construction, Key Word, Element Comparison, Conceptual Figurative, Forced Match,

Table 8.

Information Processing Component Frequencies and Percentage Occurrences Across Groups and Proverb Sets[a]

Group (n=20)	ML[b]		FL		MH		FH		Total
Components	Frequencies and (Percentage Occurrences)								
Analogy Construction (AC)	11	(2.29)	15	(3.13)	70	(14.58)	47	(9.79)	143[c]
Key Word (KW)	43	(8.96)	35	(7.29)	46	(9.58)	50	(10.42)	174[c]
Element Comparison (EC)	45	(9.38)	134	(27.92)	183	(38.13)	146	(30.42)	508[c]
Conceptual Figurative (CF)					7	(1.46)	7	(1.46)	14
Forced Match (FM)	6	(1.25)	22	(4.58)	25	(5.21)	26	(5.42)	79[c]
Surface Processing (SP)	155	(32.39)	23	(4.79)	33	(6.88)	28	(5.83)	239[c]
Personalizes Elements (PE)	48	(10.00)	125	(26.04)	49	(10.21)	24	(5.00)	246[c]
Component Combinations									
KW + EC			3	(0.63)	12	(2.50)	10	(2.08)	25
KW + FM	7	(1.46)	1	(0.21)	1	(0.21)			9
KW + SP	3	(0.63)	1	(0.21)	1	(0.21)			5
KW + PE	1	(0.21)	4	(0.83)	1	(0.21)	2	(0.42)	8
KW + EC + FM	7	(1.46)							7
KW + EC + SP							1	(0.21)	1
KW + EC + PE					1	(0.21)			1
KW + SP + PE					1	(0.21)			1
EC + FM			6	(1.25)	1	(0.21)	4	(0.83)	11
EC + SP	27	(5.63)	18	(3.75)	5	(1.04)	24	(5.00)	74
EC + PE	3	(0.63)	8	(1.67)	16	(3.33)	31	(6.46)	58
EC + FM + SP			2	(0.42)					2
EC + FM + PE	1	(0.21)							1
EC + FM + SP + PE			4	(0.83)					4
EC + SP + PE	1	(0.21)					2	(0.42)	3
FM + SP	1	(0.21)	7	(1.46)	4	(0.83)	12	(2.50)	24
FM + PE	10	(2.08)	5	(1.04)	9	(1.88)	8	(1.67)	32
FM + SP + PE	23	(4.79)	7	(1.46)			10	(2.08)	40
SP + PE	88	(18.33)	60	(12.50)	15	(3.13)	48	(10.00)	211[c]
Total	480 (100)		480 (100)		480 (100)		480 (100)		1920

[a] Refers to components in the ANALYZING episode only (see classification scheme in Table

[b] M, F, H and L refer to male, female, high, and low respectively.

[c] Components used in discussion.

Surface Processing, and Personalizes Elements is the identification of 19 combinations of these information processing components. Each component combination represents the concurrent use of two or more components. The 26 categories of information processing components comprising the ANALYZING episode and the 4 verbal reasoning groups make up the rows and columns respectively of Table 8. The figures in the last row represent the sums of observations for the 26 information processing components for each of the four verbal reasoning groups across the three proverb sets, that is, 20 students per group each ranking 24 instances for a total of 480 rankings. In addition to the frequencies of the 26 information processing components, the percentages are calculated (within parentheses) relative to the column totals, i.e. 480. The figures in the last column represent the sums of observations across the 4 verbal reasoning groups and proverb sets.

On the basis of the totals given in the final column of Table 8, the component Element Comparison was the most frequently used component across the four verbal reasoning groups and proverb sets. It was used 26.46% of the time, this value having been obtained by summing the responses of the four verbal reasoning groups across the three proverb sets. The next component according to frequency of use was Personalizes Elements which was used 12.81% of the time, followed by Surface Processing, which was used 12.45% of the time. This was followed, according to frequency of use, by the combination of the components Surface Processing and Personalizes Elements which was used 10.99% of the time. This finding, that students would concurrently use a combination of these two individual components, is understandable considering that when the frequency of use of each individual component is summed, the components were used 25.26% of the time. The next components, according to their frequency of use were Key Word followed by Analogy Construction which were used 9.06% and 7.45% of the time respectively.

The frequency of use of specific information processing components varied across the four verbal reasoning groups. No single information processing component was used with equal frequency by the four verbal reasoning groups across the three proverb sets. Preference trends are indicated by the row totals. Due to its low frequency of use, the information processing component Conceptual Figurative was excluded from the following analyses.

The data in Table 8 can be interpreted in two ways. First, comparing the components within each group allows one to construct hierarchies of preference for each group. For example, in the ML reasoning group, Surface Processing was the most frequently used component while Forced Match was the least. Second, each component allows comparisons across groups. One can observe that the Conceptual Figurative component, which is basically intuitive and abstract, was evident in the protocols of only the MH and FH reasoning groups. As well, the MH and FH reasoning groups use Analogy Construction at least 3 times more often than the ML and FL reasoning groups. In general, Element Comparison was used more often being observed in 36.20% of all responses. Element Comparison in isolation occurred in 26.46% of the responses while Element Comparison in combination occurred in only 9.74% of the responses. Key Word was the component that was most consistently used across groups.

The inversion in the frequency of use, across the groups, of the components Element Comparison and Surface Processing can be explained by referring back to the Completion Table (Table 7). In Table 7, the numbers under the second phase of the Conceptual Base Theory indicate those students who successfully negotiated the Literal Transformation Phase, that is, those students who were able to reorganize the instance and proverb elements into a format that would permit a comparison beyond the literal level. As indicated, the number of students from the ML reasoning group who

demonstrated successful negotiation of this phase is small compared to the other groups. Since the majority of students in the ML reasoning group were unable to reorganize the elements in an instance and a proverb that would permit a comparison beyond a literal level, they, by necessity, could only use the literal features of an instance and a proverb which resulted in the greater use of the Surface Processing component.

Sequences and combinations of information processing components were also observed. However, in 73.07% of the responses, students used a single component rather than a combination of components. The combination of Surface Processing and Personalizes Elements comprised 10.99% of the responses. Considering the frequency of occurrence of each individual component, it is not surprising that they occur in combination. The frequencies of use of the information processing components varied among the four verbal reasoning groups, and there was a tendency for some components not to be used by the groups. A closer look at the frequencies of component use, provides an index of apparent trends in component preference across the four verbal reasoning groups.

The observation in Table 8 of the substantially more frequent use of the component Element Comparison by the FL, MH, and FH compared to the ML reasoning group represents an extreme preferential trend. However, by observing the frequency of use of the component Surface Processing across the four verbal reasoning groups, it can be observed that the converse situation exists. Interestingly, the ML reasoning group made substantially more frequent use of the component Surface Processing than did the other three verbal reasoning groups. This finding seems noteworthy, particularly if one remembers that an essential aspect of interpreting a proverb's figurative meaning requires the comparison of various elements of the proverb. The fact that the ML reasoning group frequently used the component Surface

Processing was consistent with this group's comparatively weak ability at reorganizing elements of an instance and a proverb beyond a literal level.

Information processing component frequencies and percentage occurrence of the components for each proverb set are presented in Appendix F. These are provided as a supplement to the information provided in Table 8.

Globally, a significant association was found between information processing components and groups (x^2 = 465.12, df = 15, p = .0000). To localize the association, further analysis comparing pairs of groups was conducted. A significant association was found between the ML and FL reasoning groups and information processing components (x^2 = 182.44, df = 5, p = .0000) but there was no significant association between the MH and FH reasoning groups and the information processing components (x^2 = 8.00, df = 5, p = .1557). Since there was not significant association between the MH and FH reasoning groups and the information processing components, it was decided to combine these two groups. A significant association was found between the information processing components and the ML and the combined MH-FH reasoning groups (x^2 = 281.81, df = 5, p = .0000) and there was a significant association between the information processing components and the FL and the combined MH-FH reasoning groups (x^2 = 116.93, df = 5, p = .0000).

Information Processing Component Profiles

Information processing components profiles were extracted from the 240 protocols (80 students with 3 proverb sets each). Then information processing component profiles were displayed numerically and graphically for each group and each proverb set. Information processing components and combinations of components which were associated with less than 5% of the responses were not included in the discussion. Accordingly, six discrete information processing components as well as one

combination of components were retained for analysis: Element Comparison; Personalizes Elements; Surface Processing; combination of Surface Processing and Personalizes Elements; Key Word; Analogy Construction.

Data were analyzed at three levels of analysis. First, the data were analyzed using the frequency of occurrence as the unit of analysis to determine if there were significant associations between the patterns of component use for the proverb sets and the four groups. However, to focus solely on the frequency of component use could be misleading since group totals could be artificially inflated by the consistent use of a particular component by a few students. Consequently, a second analysis was conducted using the frequency of student who have used a component as the unit of analysis. Third, the homogeneity of proportions across groups was analyzed using the chi-square technique proposed by Marascuilo and McSweeney (1977). For all analyses, the significance level was established at $\alpha = .05$ level. Researchers in the area of figurative language generally use the .05 level of significance. Consequently, this level was also adopted for the present study in order to make meaningful comparisons with their results.

Element Comparison

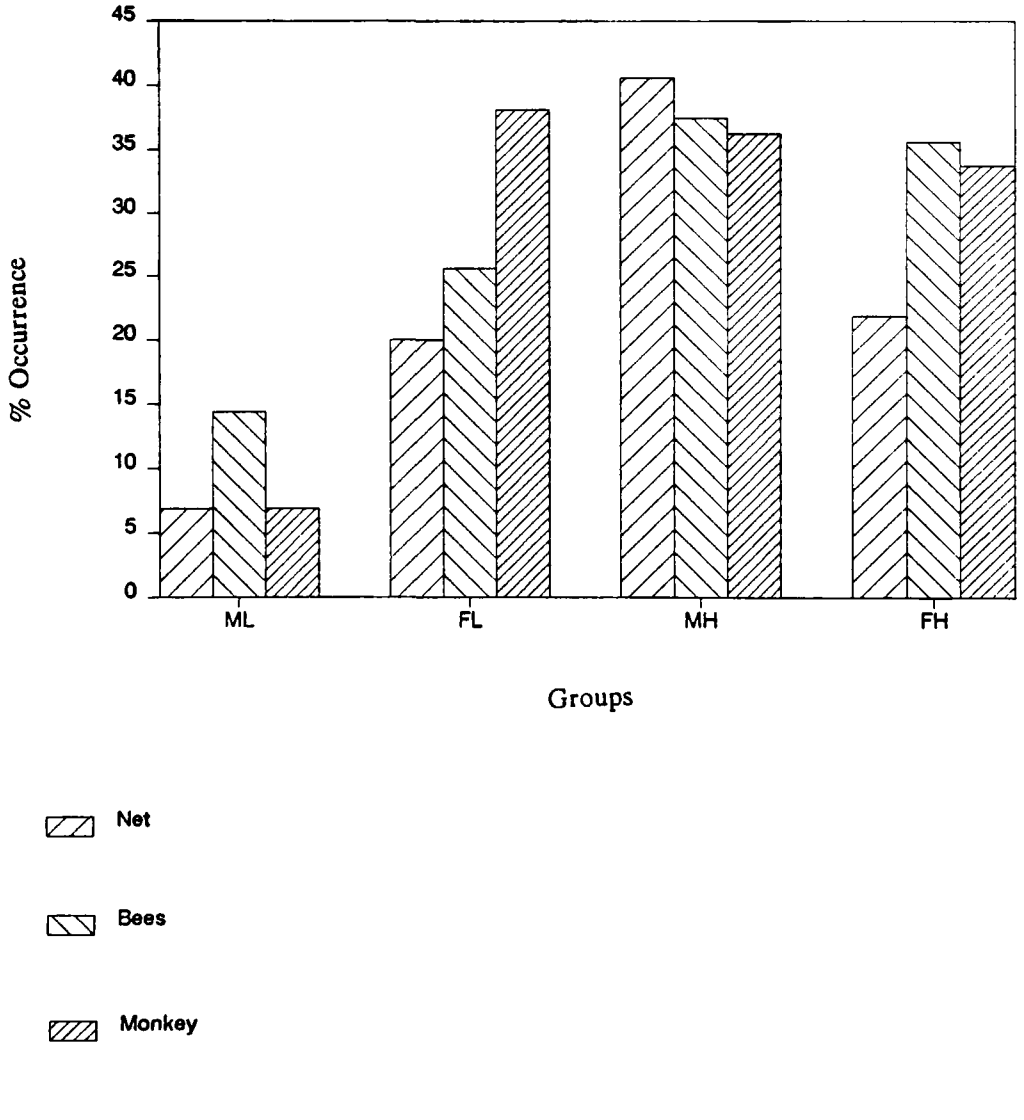
As indicated in Figure 1, the ML reasoning group used Element Comparison approximately 3 times less often than the other three groups.

Using the frequency of occurrence as the unit of analysis, there was a global association between proverb sets and groups ($x^2 = 16.38$, $df = 6$, $p = .0119$). When the ML reasoning group was excluded, there was still a significant association between groups and proverb sets ($x^2 = 10.80$, $df = 4$, $p = .0290$). While a significant association was found between proverb sets and gender ($x^2 = 8.07$, $df = 2$, $p = .0176$) no significant association was found between proverb sets and low and high verbal reasoning students ($x^2 = 2.90$, $df = 2$, $p = .2339$). Further limiting the analysis to the

Figure 1. Information processing component profile across proverb sets and groups: element comparison

Proverb	ML	FL	MH	FH	Total
Net	11 (6.88)	32 (20.00)	65 (40.62)	35 (21.88)	143
Bees	23 (14.38)	41 (25.63)	60 (37.50)	57 (35.63)	181
Monkey	11 (6.88)	61 (38.13)	58 (36.25)	54 (33.75)	184
Total	45	134	183	146	508

$x^2 = 16.38$, df = 6, p = .0119



MH and FH groups, no significant association was observed (x^2 = 5.12, df = 2, p = .0757) between proverb sets and groups.

Isolating the proverb sets Bees and Monkey, there was a significant association between proverb sets and groups. Similarly, there was a significant association between the proverb sets Net and Monkey and groups. However, using the proverb sets Net and Bees, there was no significant association between proverb sets and groups. The results of the degree of association between proverb sets and groups for the frequency of use of the component Element Comparison is presented in Appendix H.

When the classification of students is based on those who used the component Element Comparison across proverb sets and groups is provided in Table 9. Since no significant association was found between proverb sets and groups (x^2 = .92, df = .6, p = .9869) one may conclude the patterns of use of the Element Comparison component are similar for each proverb set across the groups. As a natural follow-up, one may ask: what are the characteristics of this common pattern? Consequently, the equality of proportions was tested using the chi-square technique proposed by Marascuilo and McSweeney (1977).

Based on data in Table 9, the hypothesis on equality of proportions between groups is rejected (x^2 = 40.44, df = 3, p = .0000). A post hoc analysis leads to the conclusion that the proportions of FL, MH, and FH verbal reasoning students who used this component are equal (x^2 = .87, df = 2, p = .6542) but all different from the ML verbal reasoning group (x^2 = 39.78, df = 1, p = .0000). Basically, there is a pattern in the use of the component Element Comparison indicating that the FL, MH, and FH verbal reasoning groups make equivalent use of Element Comparison significantly more often than the ML verbal reasoning group.

Table 9.

Cross Classification of Students Who Used Element Comparison

Proverb Set	ML	FL	MH	FH	Total
Net	6	14	17	14	51
Bees	6	15	14	16	51
Monkey	9	16	17	19	61
Total	21	45	48	49	163

$x^2 = .92$, df = 6, p = .9869

Essentially, this component represents an analogic structure which was then used to compare elements within an instance and, subsequently, to elements in a proverb. However, the use of an analogic structure is not to be confused with the construction of a proportional analogy which will be discussed later. When taken in conjunction with the phases of the Conceptual Base Theory presented in Table 7, one can observe that the frequency of use of this component in a group generally corresponds to the rate with which members of that group were able to complete the Literal Transformation phase (phase 2). For example, the profile in Figure 1 for the FL reasoning group indicates an increase in the use of this component from Proverb Set 1 Net through to Proverb Set 3 Monkey. This corresponds to the number of students within this group who were able to negotiate Phase 2, which increases from Proverb Set 1 to Proverb Set 3 (10, 12, and 16 students respectively).

A sample from the protocol of Student 71 provides an example of this component as the student explains the reason for ranking the instance, The fireman's suit didn't protect him from the high temperature. "That's because the suit was sort of faulty and that going back to something, sort of, back to here because the faulty instrument. If it didn't work properly then it couldn't protect him." The student has compared the elements of this instance to the elements of a previously ranked instance with a common theme.

In the following protocol Student 70 used Element Comparison to identify the relationship between the proverb Bees have honey in their mouths and stingers in their tail and its best abstract instance, Some things that look good on the surface may turn out to be totally bad. "The bee looks nice but then when you really think about it, it has a stinger and it can really hurt you, so the same thing like here it says some things look good on the surface may turn out to be totally bad."

Personalizes Elements

Figure 2 indicates that students in the FL verbal reasoning group were more inclined to make a personal comment and relate the literal situation implied by an instance and/or a proverb to their own experience. Rather than base their rankings on how well the instance matched the proverb, students who used this component tended to rank an instance to their personal reaction to it. For example, Student 43, proverb set Monkey, personalized the content of the worst/irrelevant abstract sentence "Broken instruments don't have to be thrown away" and ranked it fourth. The student explained that "I don't feel that the broken instrument, like I don't think they should be thrown away, they could be fixed so I'll put it here."

Using the frequency of occurrence as the unit of analysis, there was a significant association, globally, between proverb sets and groups (x^2 = 36.96, df = 6, p = .0000). A significant association was found between proverb sets and gender (x^2 = 14.91, df = 2, p = .0009) as well as between low and high verbal reasoning students and proverb sets (x^2 = 14.92, df = 2, p = .0009). There was not, however, a significant association between proverb sets and the ML and FL verbal reasoning students (x^2 = 1.36, df = 2, p = .0887).

For the proverb sets Net and Bees, there was a significant association between these proverb sets and groups. A significant association was also found between the proverb sets Net and Monkey and groups, and between the proverb sets Bees and Monkey and groups.

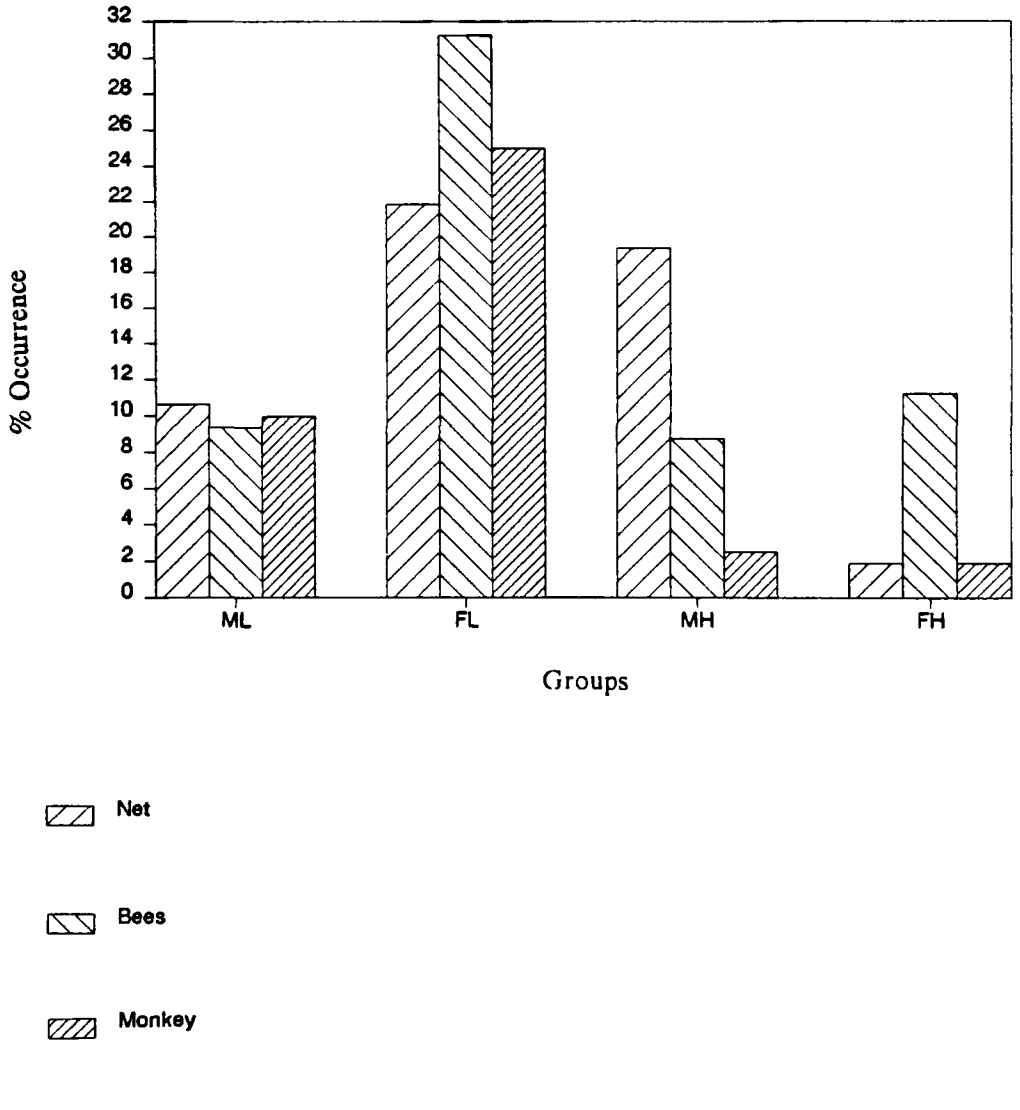
Focusing on the proverb sets Net and Bees, significant associations were found except for the low verbal reasoning and high verbal reasoning groups, ML and FL verbal groups, and for ML and MH verbal groups.

For the proverb sets Net and Monkey, significant associations were found except for the ML and FL verbal reasoning groups as well as FL and FH verbal reasoning groups.

Figure 2. Information processing component profile across proverb sets and groups: personalizes elements

Proverb	ML	FL	MH	FH	Total
Net	17 (10.63)	35 (21.87)	31 (19.37)	3 (1.88)	86
Bees	15 (9.38)	50 (31.25)	14 (8.75)	18 (11.25)	97
Monkey	16 (10.00)	40 (25.00)	4 (2.50)	3 (1.88)	63
Total	48	125	49	24	246

$x^2 = 36.96$, df = 6, p = .0000



For the proverb sets Bees and Monkey, significant associations were found between the proverb sets and groups except for males and females, for the ML and FL verbal reasoning groups, and for the MH and FH verbal reasoning groups. The degree of association between proverb sets and groups for the frequency of the information processing component Personalizes Elements is presented in Appendix I.

The classification of students who used the component Personalizes Elements across proverbs sets and groups is provided in Table 10. Since no significant association was found between proverb sets and groups ($x^2 = 6.56$, df = 6, p = .3645) the data were analyzed to test for equality of proportions.

Based on data in Table 10, the hypothesis on equality of proportions between groups is rejected ($x^2 = 10.08$, df = 3, p = .0180). A post hoc analysis indicated that the proportions of ML, MH, and FH verbal reasoning students who used this component are equal ($x^2 = 2.79$, df = 2, p = .6811) but all different from the FL group ($x^2 = 5.67$, df = 1, p = .0165). In other words, the patterns in the use of the component Personalizes Elements indicate that the FL verbal reasoning groups used Personalizes Elements more often than the ML, MH, and FH verbal reasoning groups although the latter groups used the component equally.

Surface Processing

As indicated in Figure 3, the ML verbal reasoning group used the component Surface Processing four times as often as any of the other three groups. It has been suggested that one of the reasons accounting for this high frequency of use was the inability of the students in this group, generally, to go beyond the literal features of an instance. There is little doubt that this group's high frequency of use of this component accounts for their low performance on the ranking tasks. As can be observed in Figure 3, there is a large discrepancy in the use of the component Surface Processing among the four groups. The ML verbal reasoning group used this component, in total, almost

Table 10.

Cross Classification of Students Who Used Personalizes Elements

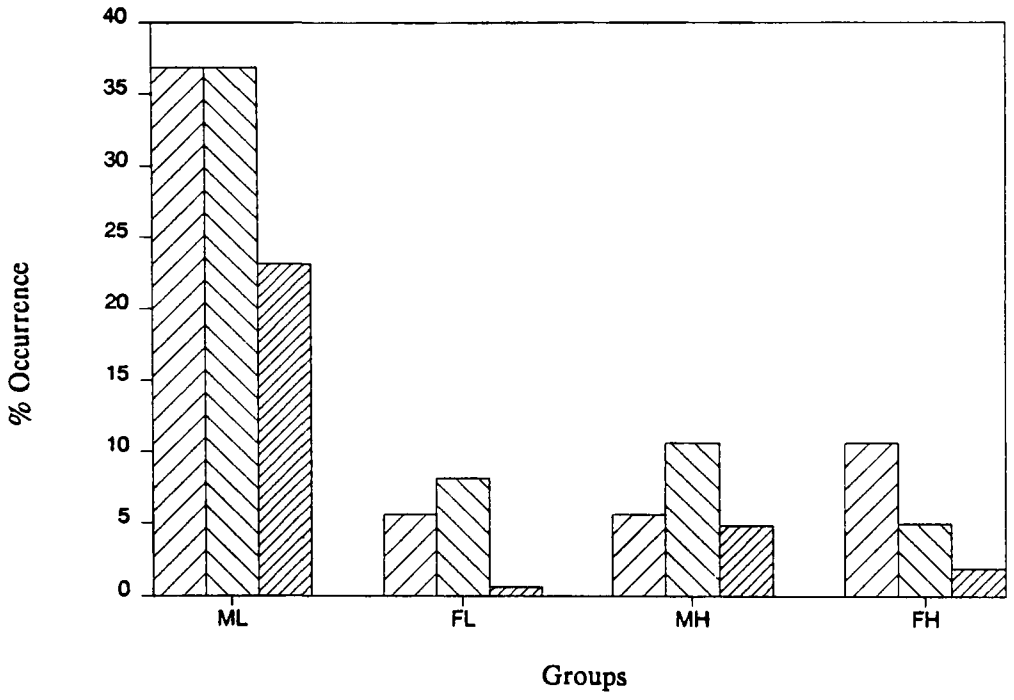
Proverb Set	ML	FL	MH	FH	Total
Net	4	6	8	2	20
Bees	4	11	5	6	26
Monkey	5	9	2	3	19
Total	13	26	15	11	65

$x^2 = 6.56$, df = 6, p = .3645

Figure 3. Information processing component profile across proverb sets and groups: surface processing

Proverb	ML	FL	MH	FH	Total
Net	59 (36.88)	9 (5.62)	9 (5.62)	17 (10.63)	94
Bees	59 (36.88)	13 (8.13)	17 (10.63)	8 (5.00)	97
Monkey	37 (23.13)	1 (0.63)	7 (4.83)	3 (1.88)	48
Total	155	23	33	28	239

$x^2 = 13.38$, df = 6, p = .0374



twice as often as the other three groups combined. Within the ML verbal reasoning group, the component was used equally during the ranking of the instances for the Net and Bees proverb sets. The component was used less often in the Monkey ranking task.

An analysis of the frequency of occurrence of the component Surface Processing indicated a significant association between proverb sets and groups (x^2 = 13.38, df = 6, p = .0374) as well as between proverb sets and the MH and FH verbal reasoning groups (x^2 = 6.94, df = 2, p = .0305). As indicated in Appendix J, there were no significant associations between any pairs of proverb sets and groups.

The classification of students who used the component Surface Processing across proverb sets and groups is presented in Table 11. The frequencies for the FL, MH, and FH verbal reasoning groups were too low to have a global chi-square; therefore, the column totals form the above three groups were combined to compute a chi-square value. No significant association was found between proverb sets and groups (x^2 = .69, df = 2, p = .7134).

Based on the data in Table 11, the hypothesis on equality of proportions between groups is rejected (x^2 = 16.64, df = 3, p = .0012). A post hoc analysis indicated that the proportions of FL, MH, and FH verbal reasoning students who used the component are equal (x^2 = 2.62, df = 2, p = .2690) but different from the ML verbal reasoning group (x^2 = 19.91, df = 1, p = .0000). Therefore, the pattern in the use of Surface Processing indicates that the ML verbal reasoning group used Surface Processing more often than the FL, MH, and FH verbal reasoning groups and that the latter groups used Surface Processing equally as often.

An example of the use of this component is provided in the protocol of Student 15. When this student was asked what the proverb Bees have honey in their mouths and stingers in their tails might mean, the student replied, "It's like - it's explaining how

Table 11.

Cross Classification of Students Who Used Surface Processing

Proverb Set	ML	FL	MH	FH	Total
Net	10	3	2	7	22
Bees	10	4	4	4	22
Monkey	6	1	1	2	10
Total	26	8	7	13	54

$x^2 = .69$, df = 2, p = .7134

Note. Due to low frequencies, groups FL, MH, and FH were combined.

they carry their honey. Yeah, it means that the bees carry it in their mouth. And the stingers in their tails - that's like to protect them". The student was unable to derive any meaning from the proverb except for a literal, surface interpretation even when prompted for alternative and additional interpretations. For this student, every instance was irrelevant to the proverb. It would be interesting to determine if these results for this group carry over into their school performance. One would be inclined to predict that they would approach most of their reading material across the curriculum using the same literal analysis which would result in their restricted performance.

Combination of Surface Processing and Personalizes Elements

The data presented in Figure 4 indicate that the MH verbal reasoning group used the combination of components Surface Processing and Personalizes Elements at least three times less often than each of the other groups. The ML verbal reasoning group used this component most often.

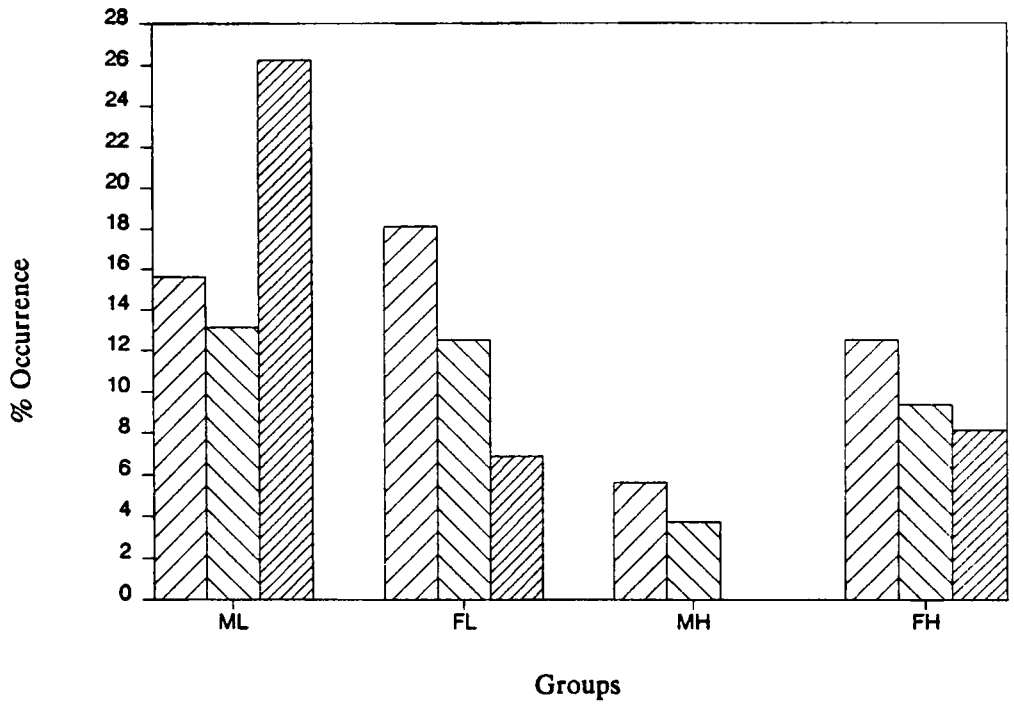
Globally, a significant association was found between proverb sets and groups (x^2 = 23.25, df = 6, p = .0007). Significant associations were also found between: proverb sets and gender (x^2 = 8.54, df = 2, p = .0141); proverb sets and male and female, low verbal reasoning groups (x^2 = 13.64, df = 2, p = .0015); and between proverb sets and male, low and high verbal reasoning groups (x^2 = 12.31, df = 2, p = .0026). The degree of association between proverb sets and groups in terms of the frequency of use of the component Surface Processing and Personalizes Elements is presented in Appendix K.

A significant association was found between the proverb sets Net and Monkey and the four groups. Similarly, a significant association was found between the proverb sets Bees and Monkey and the four groups. However, no significant association was found between the proverb sets Net and Bees and the four groups.

Figure 4. Information processing component profile across proverb sets and groups: surface processing and personalizes elements

Proverb	ML	FL	MH	FH	Total
Net	25 (15.62)	29 (18.12)	9 (5.62)	20 (12.50)	83
Bees	21 (13.13)	20 (12.50)	6 (3.75)	15 (9.38)	62
Monkey	42 (26.25)	11 (6.88)	-	13 (8.13)	66
Total	88	60	15	48	211

$x^2 = 23.25$, df = 6, p = .0007



The cross classification of students who used the combination of Surface Processing and Personalizes Elements is presented in Table 12. Although the cells in Table 12 are relatively small, they indicate a fairly stable pattern with no significant association between proverb sets and groups (x^2 = 5.41, df = 6, p = .5060). The hypothesis on the equality of proportions is confirmed based on the data from Table 12 (x^2 = 4.52, df = 3, p = .2093). Thus, the four groups made equivalent use of the combination of components Surface Processing and Personalizes Elements.

An example of a typical response of the students who used this combination of components is provided in the protocol of Student 14, proverb set Monkey. The student gives the reasons for his ranks, "This 'cause she shouldn't go into the thin ice. That one - 'cause he shouldn't blame the manager; it's not his fault. This one 'cause he should give some credit to his assistant." Frequently, the protocols of the students who used this combination of components contained the words "should" or "shouldn't". It was observed that these students read an instance, then dealt only with the literal features. Once the students had reached an impasse, they would relate the instance to their own experience or comment upon the literal situation or scenario depicted by the instance. Thus, the students used a combination of two discrete components. Again, one would predict that this combination of information processing components would be observable in the students' performance in various subjects at school.

Key Word

This component was the most consistently used across the proverb sets. As indicated in Figure 5, there is little variation in the use of this component by each of the four groups; however, the row totals indicate a substantial variation in the frequency of use of this component by the groups for the three proverb sets.

The proverb set that is associated with the most frequent use of the component Key Word is The monkey takes the chestnuts out of the fire with the dog's paw.

Table 12.

Cross Classification of Students Who Used Combination of Surface Processing and Personalizes Elements

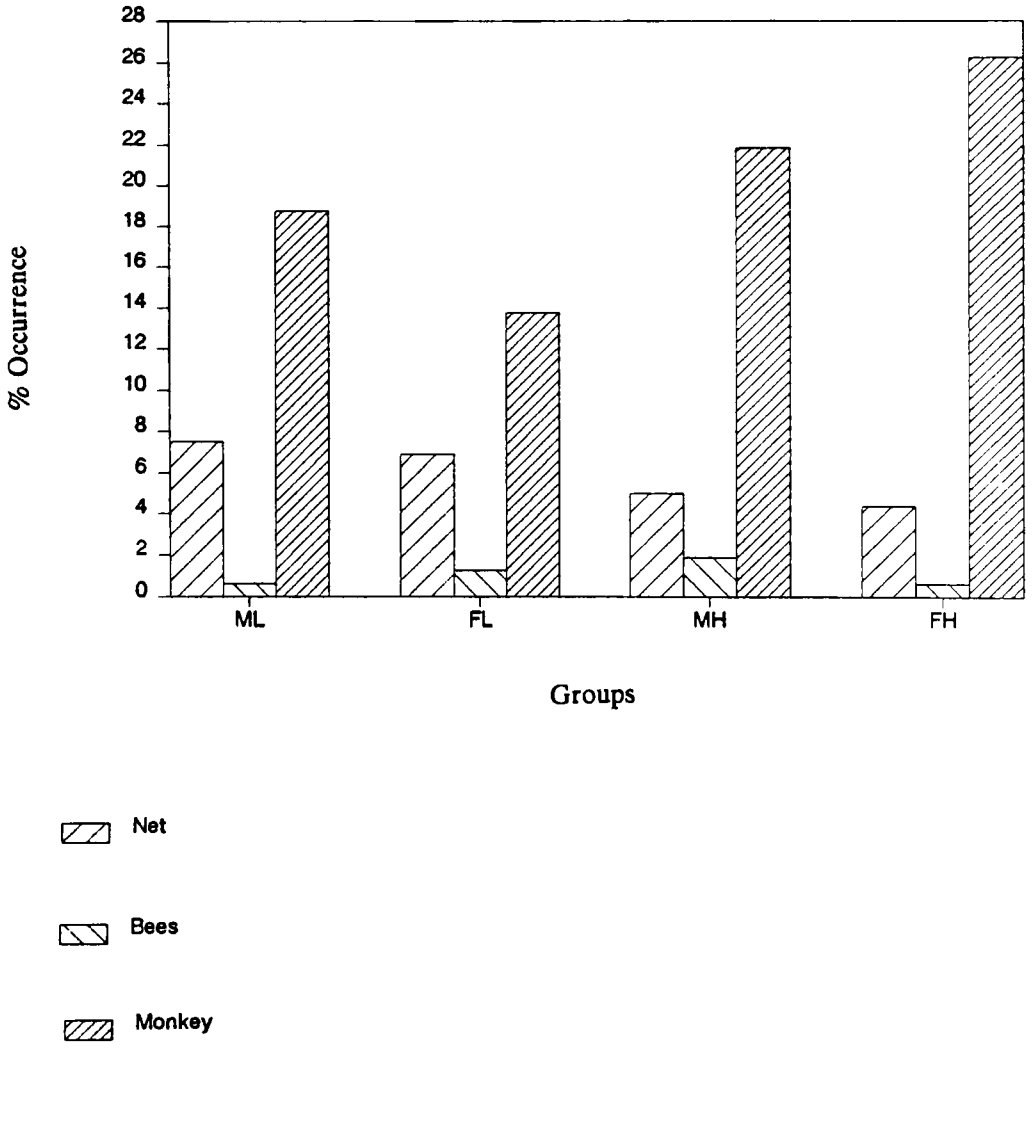
Proverb Set	ML	FL	MH	FH	Total
Net	4	5	3	4	16
Bees	3	7	4	4	18
Monkey	6	4	-	3	13
Total	13	16	7	11	47

$x^2 = 5.41$, df = 6, p = .5060

Figure 5. Information processing component profile across proverb sets and groups: key word

Proverb	ML	FL	MH	FH	Total
Net	12 (7.50)	11 (6.87)	8 (5.00)	7 (4.38)	38
Bees	1 (0.63)	2 (1.25)	3 (1.88)	1 (0.63)	7
Monkey	30 (18.75)	22 (13.75)	35 (21.88)	42 (26.25)	129
Total	43	35	46	50	174

$x^2 = 7.19$, $\underline{df} = 6$, $\underline{p} = .3033$



Generally, the use of this component is equally distributed among the four groups for this particular proverb set.

There was no significant association between proverb sets and groups (x^2 = 7.19, df = 6, p = .3033). The cross classification of students who used the component Key Word is given in Table 13. No significant association was found between proverb sets and groups (x^2 = 1.04, df = 6, p = .9825).

Based on the data from Table 13, the hypothesis on the equality of proportions is confirmed (x^2 = 1.47, df = 3, p =.6929). In other words, the four groups made equivalent use of the component Key Word across the proverb sets.

Basically, students who employed this component, searched for one or two words in either an instance or a proverb that could be used interchangeably. For example, in the Monkey proverb set, students would often focus on the words "take" and "with" in the proverb to arrive at answers that could be used to guide the rankings of the instances. This process is evident in the protocol of Student 24 "The guy takes something with someone else - like, he uses somebody to take what he wants".

A possible reason for the greater frequency of use of this component in the Monkey proverb set rests in the structure of the proverb itself. The words "take" and "with" suggest a two step structure, that might facilitate a search for comparable items among the instances. Students could well have posed condition "take with what?" and searched the instances for words or phrases that would fit this structure. The other proverb sets do not have this structure.

Analogy Construction

Figure 6 presents a profile of the occurrence of the component Analogy Construction across the proverb sets and verbal reasoning groups. One of the frequently cited explanations of figurative understanding suggests a transfer of meaning between two or more initially disparate items using verbal analogic reasoning

Table 13.

Cross Classification of Students Who Used Key Word

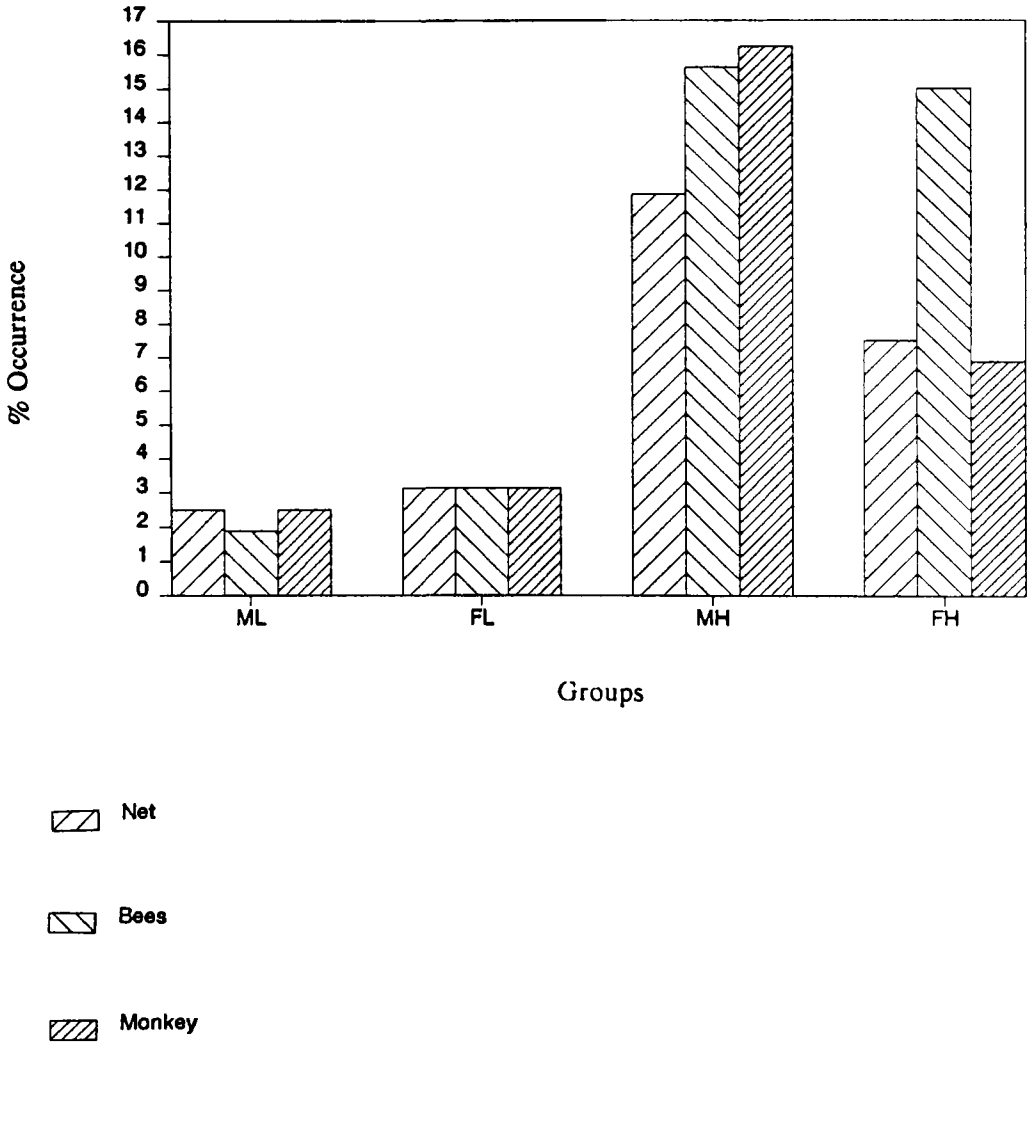
Proverb Set	ML	FL	MH	FH	Total
Net	3	4	3	5	15
Bees	1	1	2	1	5
Monkey	7	7	7	10	31
Total	11	12	12	16	51

$x^2 = 1.04$, df = 6, p = .9825

Figure 6. Information processing component profile across proverb sets and groups: analogy construction

Proverb	ML	FL	MH	FH	Total
Net	4 (2.50)	5 (3.12)	19 (11.87)	12 (7.50)	40
Bees	3 (1.88)	5 (3.12)	25 (15.63)	24 (15.00)	57
Monkey	4 (2.50)	5 (3.12)	26 (16.25)	11 (6.88)	46
Total	11 (6.88)	15 (9.36)	70 (43.75)	47 (29.58)	143

$x^2 = 4.66$, df = 6, p = .5907



(Hoffman, 1983). The, items are represented as a four-term analogy A:B::C:D. Analogic reasoning presumes that an understanding of two or more terms in a figurative expression is the result of a process in which an individual must first find some term D that relates to some term C in the same way that term B relates to term A. Honeck et al. (1980) suggest that the construction of a four-term analogy is involved in the interpretive process but did not provide empirical support for this suggestion. The results presented in Figure 6 indicate that students do construct four-term analogies.

As indicated in Figure 6, the high verbal reasoning groups used the component Analogy Construction at least three times as often as did the low verbal reasoning groups. One would expect this discrepancy considering that the construction and resolution of a four-term analogy requires both verbal and abstracting skills.

The use of this component is generally consistent for the ML and FL verbal reasoning groups. Rather than construct a verbal analogy, which requires that individuals identify a higher-order relationship that exists between two or more items, the students in these groups tended to focus on the literal aspects or features in the proverbs and instances.

The MH verbal reasoning group was the group that used this component most often. Slight variations existed between this group's use of the component across the proverb sets. A look at the graph for the FH verbal reasoning group, however, reveals an interesting discrepancy in the percentage of occurrence of the component Analogy Construction across the proverb sets. This group used Analogy Construction twice as often for the Bees proverb set compared to the Net and Monkey proverb sets. It appeared that the contrasting items in the Bees proverb set, that is mouths-tail, front-back; honey-stingers, nice-bad, presented an analogic structure that was reformulated into an analogic process. These contrasting items, perhaps, were not as

apparent in the other proverb sets. For example, Student 73 explains the reason for selecting the instance, Some things that look good on the surface may turn out to be totally bad: "Yeah, okay this is number one - it's the best 'cause some things may look good on the surface is the honey - like honey tastes good, and, it may turn out to be totally bad - like it can make you sick - is the stingers - like it hurts a lot". The student has constructed a four-term analogy, some things that look good on the surface:bees have honey in their mouths::may turn out to be totally bad:bees have stingers in their tails, which is then used to determine the rank of a particular instance.

Globally, as indicated in Figure 6, the patterns of Analogy Construction were the same across the proverbs. That is, there was no significant association between proverb sets and groups (x^2 = 4.66, df = 6, p = .5907). In terms of frequency of occurrence of this component, there was no significant association between the ML and FL verbal reasoning students (x^2 = .68, df = 1, p = .5839). However, a significant association in the probability of the use of Analogy Construction was found between the MH and FH verbal reasoning students (x^2 = 7.65, df = 1, p = .0559). As there was no significant association between ML and FL verbal reasoning groups, their column totals were combined for purposes of comparison (i.e. the totals of the two low verbal reasoning groups were combined and subsequently compared to the totals for each of the high verbal reasoning groups). The results indicated that there was a significant association in the probability of instances of Analogy Construction between the combination of the low groups and the male, high verbal reasoning group (x^2 = 87.20, df = 1, p = .0000) and between the combination of the low groups and the female, high verbal reasoning group (x^2 = 38.17, df = 1, p = .0000).

Since there was no significant association found globally using frequency of occurrence of the component Analogy Construction, an analysis was conducted using the students who used the component as the unit of analysis. The cross classification

of students who used Analogy Construction is presented in Table 14. Since there was no significant association between proverb sets and the four groups in terms of the students who used this component (x^2 = 2.46, df = 6, p = .8728) one may conclude the patterns of use of the Analogy Construction component are similar for each proverb set across the groups. Therefore, the equality of proportions was tested. Based on the totals in Table 14, the hypothesis of equality of proportions was rejected (x^2 = 11.47, df = 3, p = .0098). A post hoc analysis indicated: that there was no significant difference between the proportions of the FL and ML verbal reasoning groups (x^2 = 1.56, df = 1, p = .2088); that there was no significant difference between the proportions of the MH and FH verbal reasoning groups (x^2 = 1.35, df = 1, p = .2439); but that there was a significant difference between the combination of the proportions of the ML and FL verbal reasoning groups compared to the combination of the proportions of the MH and FH verbal reasoning groups (x^2 = 9.91, df = 1, p = .0021).

In addition, the post hoc analysis indicated a significant difference between the proportions for the ML and MH verbal reasoning groups (x^2 = 11.38, df = 1, p = .0011) and between the proportions for the ML and FH verbal reasoning groups (x^2 = 5.21, df = 1, p = .0213). There was no significant difference between the proportions for the FL and FH verbal reasoning groups (x^2 = 1.14, df = 1, p = .2864).

The analysis of the verbal protocols from the four groups provided empirical evidence of the use of a proportional analogy during the ranking task. While use of analogic reasoning has been alluded to in other figurative language research (Honeck et al., 1985; Malgady & Johnson, 1980; Sternberg, 1985) this is believed to be one of the few times this process has been studied empirically. Yet having established the presence of this component one needs also ask how efficient it is as a process.

Table 14.

Cross Classification of Students Who Used Analogy Construction

Proverb Set	ML	FL	MH	FH	Total
Net	3	5	8	4	20
Bees	3	3	9	7	22
Monkey	1	4	6	6	17
Total	7	12	23	17	59

$x^2 = 2.46$, df = 6, p = .8728

Out of the 240 possible correct identifications of the best abstract instance of a proverb (80 students by 3 proverb sets) 91 or 37.92% correct identifications were selected. Of these 91 correct identifications, 37 (40.66%) of them were associated with the component Analogy Construction whereas 54 (59.34%) were associated with other components. As such, these results indicate that the construction of a four-term analogy is a sufficient, although not necessary, condition for the correct interpretation of a proverb. There is, however, a caveat that should be stated. Only those students who explicitly used the component Analogy Construction were included - students' use of this component may have been implicit and therefore, not observable.

Table 15 indicates the distribution of students, across proverb sets and groups, who used Analogy Construction to correctly identify the best abstract interpretation of a proverb. Reading down the columns in each table, one can determine the proportion that the component Analogy Construction was used to select the best abstract instance compared to other components. Reading across the rows, one can compare the use of this component across the four groups. By reading the third column in Table 15, (i.e. ML) one can observe that the proportion of the use of Analogy Construction compared to the use of another component(s) in the Net proverb set by ML verbal reasoning students. Out of the total of 5 correct abstract interpretations obtained in this proverb set by this group, only 1 was associated with Analogy Construction while 4 were associated with other information processing components. Thus, of the 3 students (see Table 14) in the ML verbal reasoning group for the proverb set Net who used Analogy Construction, only 1 student (see Table 15) used the component to identify the abstract interpretation of the proverb.

By contrast, it can be observed in Table 15 that during the ranking task for the Bees proverb set, the MH verbal reasoning group selected the best, abstract interpretation a total of 8 times and that 6 of these selections were associated with the

Table 15.

Frequency of Students with Respect to Use of Analogy Construction to Identify Abstract Interpretation of a Proverb

Proverb Set	Used Analogy Construction	ML	FL	MH	FH
Correct Identification of Abstract Interpretation					
Net	Yes	1	4	5	2
	No	4	3	7	3
Bees	Yes	1	2	6	4
	No	3	4	2	4
Monkey	Yes	1	4	3	4
	No	2	4	9	9
Incorrect Identification of Abstract Interpretation					
Net	Yes	0	0	1	2
	No	15	13	7	13
Bees	Yes	2	2	1	1
	No	14	12	11	11
Monkey	Yes	3	1	1	0
	No	14	11	7	7

Note. Group total per proverb set (correct + incorrect) = 20 students.

component Analogy Construction while 2 selections were associated with other components. Only 1 student had a selection associated with this component that was incorrect, that is, the student used Analogy Construction but selected an incorrect sentence. The use of this component by the MH verbal reasoning group proved to be quite efficient. For example, of the 9 students (see Table 14) in the MH verbal reasoning group who used Analogy Construction, 6 selected the best abstract instance.

Table 15 indicates that for the proverb set Monkey, 8 students in the FL verbal reasoning group selected the best abstract instance with 4 students using Analogy Construction and 4 students using other components. Interestingly, the 4 students who used the component Analogy Construction, selected the best abstract instance. For the FH verbal reasoning group for the proverb set Monkey, 13 students selected the best abstract instance with 4 students using Analogy Construction and 9 students using other components. In this proverb set, of the 6 students (see Table 14) who used the component 4 students selected the best abstract instance. Thus, although the component Analogy Construction was not necessary to select the best abstract instance, as a procedure it was observed to be useful.

These results suggest that the use of Analogy Construction, as a procedural format, could have been constrained by limited metalinguistic, or even proverbial knowledge.

The conclusions and their implications drawn from the study are presented in Chapter 5.

Chapter 5

CONCLUSIONS

The objectives of this study were:

1. to identify and describe the information processing components employed by grade nine students during the interpretation of proverbs;

2. to investigate the appropriateness of the interpretive process proposed in the Conceptual Base Theory;

3. to investigate the degree of association between the observed information processing patterns and the variables of gender and verbal reasoning ability; and

4. to investigate the role of analogy during the interpretation of proverbs.

In order to meet these objectives, a methodology was developed that was used to identify and describe the information processing components involved in the interpretation of proverbs. For Objectives one, three, and four, a classification scheme was developed that was used to categorize students' information processing components during the interpretation of proverbs. To accomplish Objective two, a completion table was developed to track the number of students per verbal reasoning group and proverb set who did, and did not, successfully negotiate the four phases proposed in the Conceptual Base Theory and who were considered to have comprehended the proverbs. Research objectives and research questions, rather than hypotheses were developed since predictions about information processing differences

could not be made because of a lack of prior research in the area. Accordingly, the study was exploratory in nature.

Data were analyzed from both a quantitative and qualitative perspective. The quantitative analysis provided information on within- and between-group differences while the qualitative analysis was used to identify information processing components and patterns contributing to these differences.

Background Information

Students were asked to think aloud while they ranked instances associated with three proverbs so that the researcher could better understand the solution process used by young adolescents during the interpretation of proverbs. Specifically, the study explored the process sequence and the information processing components involved in the interpretation of proverbs. The study centred around the development of a methodology to identify the interpretive process in a form that facilitated comparisons across proverb sets and groups.

The sample consisted of 40 males and 40 females enrolled in the ninth grade at a local high school. Four balanced groups reflected the variables of gender and verbal reasoning ability: male, high verbal reasoning (MH); male, low verbal reasoning (ML); female, high verbal reasoning (FH); and female, low verbal reasoning (FL). Grade 9 students were selected since they are confronted with a variety of figurative language in their reading material and they are likely to verbalize more since the novelty of the task and material would necessitate that the interpretive process would be executed in a controlled rather than automatized fashion.

Each student in the study was asked to complete a task that involved three proverb sets. Each proverb set contained one proverb, one abstract sentence that was an excellent interpretation of the proverb's figurative meaning, one abstract sentence

that was a poor or irrelevant interpretation of the proverb's figurative meaning, and six concrete sentences that were more or less related to the proverb's figurative meaning. The excellent (best) and irrelevant (worst) interpretations were general, abstract statements, in contrast to the six concrete sentences. Each student was asked to rank each of the eight sentences in a given proverb set according to how well each sentence illustrated the meaning of the proverb. Two correct identifications were of particular interest: the correct identification of the proverb's abstract figurative meaning and the correct identification of the abstract sentence that was irrelevant to the proverb. Each received one count resulting in a category score of either 0, 1, or 2 per proverb set.

Analysis of the Verbal Protocols

The verbal protocols generated by the students during this task were given extensive analysis. A classification scheme was developed that consisted of episodes and information processing components that were appropriate for the data in the protocols collected during this study. The episodes corresponded to the phases postulated in the Conceptual Base Theory (Honeck et al., 1980) while the information processing components were categorized using the classification scheme employing content analysis techniques.

The classification scheme gave rise to four types of episodes. Of particular interest was the ANALYZING episode type which consisted of 26 components. Seven of these were discrete, elementary processing components while 19 represented combinations of these components.

These episode types provided information about the global process involved in the interpretation of proverbs while the information processing components represented the process observed to occur at a more refined level of analysis. The resulting classification scheme was used to address the research questions.

Research Question 1.

What are the information processing components used by grade nine students during the interpretation of a proverb?

The question of how to identify and categorize the information processing components involved was resolved by developing a classification scheme using content analysis techniques. As a result, 15 global information processing components were identified across the 4 episode types (see Table 3). However, of particular interest were the 7 elementary information processing components comprising the ANALYZING episode: Analogy Construction, Key Word, Element Comparison, Conceptual Figurative, Forced Match, Surface Processing, and Personalizes Elements. These 7 components together with 19 combinations of them were used to categorize each student's response. Accordingly, the following criteria were applied: Analogy Construction: the student uses proverbs and sentence elements to construct a four-term analogy A:B::C:D that represents the shared conceptual base; Key Word: the student uses a single word from the proverb and sentence to guide the ranking of a sentence; Element Comparison: the student compares and contrasts sentence elements (perceptual or conceptual) to guide the ranking of a sentence; Conceptual Figurative: the student identifies, intuitively, an abstract relation that is used to rank the sentence; Forced Match: the student forces a match between a particular sentence and a particular proverb and uses this match to justify the sentence's rank; Surface Processing: the student uses literal information or perceptual features of a proverb and a sentence to guide the ranking of a sentence; and Personalizes Elements: the student includes a personal statement or relies upon idiosyncratic reasoning and personal experience to rank a sentence. With reference to Table 8, a hierarchy in the use of particular components can be observed. In ascending order, the following frequency of use was observed: Conceptual Figurative; Forced Match; Analogy

Construction; Key Word; Surface Processing; Personalizes Elements; and Element Comparison. In general, Element Comparison in isolation occured most often while Conceptual Figurative was used the least.

While students used a single component in 73.07% of the responses, combinations of components were also observed. The combination of components Surface Processing and Personalizes Elements was the combination used most often.

Research Question 2.

Is the negotiation of the four phase sequence proposed in the Conceptual Base Theory a prerequisite to the correct interpretation of a proverb?

The analysis of the students' protocols using the four phases proposed in the Conceptual Base Theory indicated that only those students who successfully completed the four phases were able to correctly identify both the best abstract and the worst abstract interpretations of the proverbs. The protocols of the students who completed the four phases revealed that they constructed a conceptual base that was used to complete the ranking task. The construction of a conceptual base was necessary to relate events that were dissimilar on a literal level, so that a common meaning could be inferred which was then used to guide the ranking task.

Students who did not construct a conceptual base and who relied solely on the literal level of a sentence were unable to infer a general underlying theme that could be used during the ranking task. Glaser and Pellegrino (1982) suggest that one of the reasons that individuals have difficulty making inferences is because their knowledge has been encoded at the surface level and they have not employed conceptual forms of knowledge that constrain their induction of relations. The completion table developed and used in this study has implications for further use as it provides an initial diagnostic framework for examining the problem solving process involved in the interpretation of proverbs.

Research Question 3.

Is there an association between the observed information processing patterns demonstrated by the grade nine students and the independent variables of gender and verbal reasoning ability?

The application of the classification scheme yielded information processing component frequencies across the four groups and the three proverb sets. The information processing components and their cumulative frequency and percentage of occurrence are presented in Table 8. This data can be interpreted in two ways. First, comparing the components for each group allows one to construct hierarchies of information processing component preference for each group. For example, in the Male, low verbal reasoning group, Surface Processing was the most frequently used component while Forced Match was the least. In the Female, low verbal reasoning group, Element Comparison and Personalizes Elements were the most frequently used components while Analogy Construction was the least. In the Male, high verbal reasoning and Female, high verbal reasoning groups, Element Comparison was the most frequently used component while Conceptual Figurative was the least. As indicated by the high frequency of responses categorized as Surface Processing, the Male, low verbal reasoning group tended to provide literal interpretations that were often the result of focusing on features in a sentence. In general, the hierarchy of preference, in increasing order, across proverb sets and groups was: Conceptual Figurative, Forced Match, Analogy Construction, Key Word, combination of Surface Processing and Personalizes Elements, Surface Processing, Personalizes Elements, and Element Comparison.

Significant differences in category scores were found between the verbal reasoning groups but no such differences were found between males and females. This adds an additional perspective to the discussion over the role of analogy during proverb

interpretation since verbal reasoning was determined using a measure that is essentially an analogies test using four-term analogies. While the role of analogy requires further research, one may conclude that the results from the present study add something to the existing knowledge about "what it means to be high verbal" (Hunt, Lunneborg, & Lewis, 1975). The results indicate that high verbal students and low verbal students can be identified on the basis of their verbal protocol characteristics. The high verbal students, among other things, tended to use the elements of a sentence and they tended to relate sentences that were dissimilar on a literal level. By contrast, because low verbal students tended to focus on the literal meanings of the words in the sentences they had difficulty moving beyond the literal elements to construct the figurative meaning. An intriguing research question is whether low verbal students would benefit from training in using the information processing components used by the high verbal students.

Research Question 4.

Is the construction of a four-term analogy a necessary and sufficient condition for the correct interpretation of a proverb?

Much has been written about the role of analogy in the interpretation of figurative language (Hoffman, 1983; Honeck et al., 1980; Pollio & Smith, 1980; Sternberg, 1985; Tourangeau & Sternberg, 1982). One of the frequently cited explanations of figurative understanding suggests a transfer of meaning between two or more initially disparate items using analogic reasoning.

The examination of the component Analogy Construction suggests that there are two formats of analogy: one as a structure and the other as a process. The results in this study indicated that students were able to use various information processing components to select the correct instance in the ranking task. Thus, there was a

transfer of meaning yet it did not necessarily depend on the use of the Analogy Construction component. However, this is not to imply that the process used, in terms of information processing components, did not occur within an analogy paradigm or structure. The components Element Comparison and Analogy Construction represent implicit and explicit types of reasoning by analogy. When the two components are combined, they were observed in 33.90% of the responses. Perhaps the rationale for this lies in the task. It could be that explicit four-term analogy tasks of the form A:B::C:D do no reflect all of the processes that might occur during the interpretation of proverbs or other figurative language. While the component Analogy Construction was observed to be the most efficient component, it was not the only component associated with the selection of a correct abstract instance, that could also serve as the best interpretation, to a proverb. This latter finding supports the results of previous research (Schoenfeld, 1985; Simon, 1978) which found that the use of different information processing components can produce functionally equivalent results.

Implications of the Methodology

An issue facing those who wish to study the cognitive processes involved in a task is that the processes which constitute performance tend not to be directly observable. Therefore, the first goal in this study was to locate a methodology that would facilitate the identification of the interpretive processes involved in the comprehension of proverbs.

A promising approach was to use the students' verbal protocols as data. These verbal protocols were obtained by asking students to think aloud while working on the task. The protocols were analyzed using content analysis techniques to develop a classification scheme to represent sequences of component processes and to evaluate the four phase sequence proposed in the Conceptual Base Theory.

As indicated by Table 7, analysis of students' verbal protocols not only confirmed the sequence suggested by this theory, but allowed the researcher to identify, in the case of students who did not correctly rank the best and worst instances, the phase that the students failed to negotiate. Thus, the methodology developed as part of the this study used in concert with the four phases of the Conceptual Base Theory, could be used by teachers who want to analyze and compare the interpretive processes of their students. In addition, it is likely that the teacher who used the classification scheme developed for this study, or a modification of it, to investigate the interpretive processes would gain insights into his students' thinking that could be used in teaching. At the outset of this study, the interpretation of proverbs was categorized as a problem solving activity. If teachers were trained to listen to a student solving problems aloud and then to classify the processes observed, they would surely gain insights into the learning process which could be used to improve their teaching and by extension a student's learning.

Facility with figurative language is important for both social and academic success (Nippold, 1985). A student's inability to comprehend figurative language can lead to peer rejection when a student does not understand the language of the group. In education, figurative language can be used to extend capacities for perceiving relationships in the perceptual domain to conceive of relationships in the conceptual domain. Even though teachers claim that language comprehension difficulties are caused by figurative language, the teaching of figurative language is given little attention in school (Wiig & Semel, 1984). Why is this so?

Perhaps an answer lies in the fact that few figurative language tasks have been analyzed in sufficient detail to identify the underlying processes involved in figurative interpretation and comprehension. This study represents a shift in focus from product to process in that it focuses on how a student comes to a figurative understanding rather than on what a student can understand.

Taken together, the process sequence of the Conceptual Base Theory and the methodology used in this study offer insights into the interpretive process not available to product-oriented research. The classification scheme will undergo further refinement each time it is used. For now, its applicability may be restricted since it was designed for proverbs. It needs to be applied to other figurative material to determine if the results obtained in the present study are maintained.

Implications of Information Processing Component Profiles

It is reasonable to predict that the information processing component profiles could be applied to individuals although a discussion of the profiles in relation to individuals has occurred only tangentially in this study. Nonetheless, there is confidence in this prediction considering how the profiles were observed to be a useful diagnostic tool when applied to groups. The profiles would allow the educator to identify a student's strengths and weaknesses, which would, hopefully, be used to design appropriate teaching strategies as well as materials. In addition, teachers could use group profiles to better understand how successful groups of students are using particular information processing components. For example, the teacher who knows that a student relies on Surface Processing during a reading task, will focus instruction on using literal details of setting, character, and plot to construct the underlying meaning not directly specified by the text. Thus, the teacher could observe the processes used and not used and could introduce the student to other information processing components that would facilitate uncovering the underlying meaning. Accordingly, observing processes has important diagnostic implications.

Language, especially figurative language, is fundamental to listening, speaking, reading, and writing which are, in turn, fundamental to educational and social development. While, it is important for educators to understand students' information

processing abilities, it is imperative that educators of "exceptional" students understand these processes. These latter students are frequently exposed to conversations and reading material consisting of language and terms they do not understand. Knowing that particular students, or groups of students, are restricted due to a weakness in, or absence of, information processing components, allows the educator to provide an appropriate teaching programme.

The study, quite properly, has raised more questions than it has answered. Many of these questions have been discussed earlier, but several bear further commentary.

It would appear that the students who were able to correctly identify the best abstract sentence had a "repertoire of relations" rich enough to enable them to identify a relation between elements in the proverb and a relation between elements in the instance. For example, there are multiple relations in the proverb and multiple relations in an instance. To correctly interpret the proverb, a student had to select among the possible relations in the proverb and among the possible relations in an instance. It would appear that to correctly interpret a proverb requires that one essentially disregard the elements in order to learn the meaning which is based entirely on relationships. Accordingly, an interesting question concerns the quantity and kinds of relations available to students. For instance, students could be given a proverb and asked to list the kinds of relations that can be established between elements in the proverb. This could then be used to develop an index of a student's "repertoire of relations".

Information processing components used during the interpretive process were revealed in the study but what caused a student to use a particular component over another? Further research that would investigate this question is needed.

Finally, the results of the study demonstrate, clearly, that the cognitive processes involved in the interpretation of figurative language are very complex. While the

results are generally consistent with the results in research on cognitive processing and problem solving, further research is required that focuses specifically on the interpretive processes involved in the interpretation and comprehension of figurative language.

Evaluative Summary

To gain a better understanding of the interpretive process involved in the comprehension of proverbs, it was necessary to first analyze the literature on cognitive processing and figurative language to identify factors that relate to interpretive abilities, and second, to identify an approach or methodology for collecting and analyzing data. While the literature provided examples of how tasks could be decomposed into information processing components though the analysis of verbal protocols, there was a dearth of information dealing specifically with figurative language, and even less dealing with proverbs.

A relevant model of the interpretive process involved in the interpretation of proverbs was provided by the Conceptual Base Theory (Honeck et al., 1980). This study conceptually extended this theory by incorporating a methodology that permitted an empirical evaluation of the four phase sequence proposed in the Conceptual Base Theory.

This study was exploratory and mainly qualitative in nature. The process involved in data collection and analysis in qualitative types of research is both lengthy and time consuming; therefore, the sample size is often restricted. Accordingly, the sample size of 80 is large from a qualitative perspective but it was considered desirable to enable information processing components to be identified with a reasonable degree of stability and to facilitate a complementary quantitative analysis of the data. Where the quantitative analysis identified significant intra-group and inter-group differences,

information processing patterns contributing to these differences were identified and described.

Contributions of the Study

In a broad sense, an implicit purpose of this study was to make a contribution to the understanding of the interpretive process involved in the comprehension of figurative language in general and proverbs in particular. Proverbs were selected as a focus of the study since the construction of a correct, figurative interpretation to a proverb represents a complex linguistic and problem solving activity requiring an ability to translate concrete symbols into generalized, abstract concepts.

Thus, in its conceptualization, design, and methodology, the study incorporated elements from previous research relating to both linguistics and problem solving. In addition, a constant emphasis was on describing the process that lead to the end product. In this regard, the expectation was that identifying the components used by the students as they completed the ranking task would provide insights into the interpretive process, and that knowledge about the interpretive process gained in this manner could lead to instructional procedures which might result in the improvement of figurative comprehension.

Specific contributions of the study are as follows:

1) The development of a methodology for analyzing the interpretive processes involved in the interpretation of proverbs.

2) The demonstration of the utility of the methodology through group information processing component profiles and a discussion of how the methodology complements the process sequence of the Conceptual Base Theory.

3) The development of a classification scheme providing a diagnostic framework that can be applied to the Figurative Phase of the Conceptual Base Theory to identify and describe information processing components.

4) The potential of verbal protocols as a diagnostic tool for evaluating the cognitive processes of students during problem solving.

5) Information concerning the prevalence of, and integral role played by, figurative language in education.

6) Information concerning the cognitive and linguistic complexity, as well as the educational value, of studying proverbs.

Suggestions for Further Research

Further research using the methodology and classification scheme of this study should be undertaken to examine information processing characteristics and differences among "exceptional" and "non-exceptional" students. There are a number of categories of exceptional students (deaf, learning-disabled, etc.) with known language comprehension problems. The literature suggests that there are differences in the cognitive functioning of these students and that they are usually deficient in their ability to process and comprehend figurative language. An analysis of these students' repertoire and use of information processing components during the interpretation of figurative language would contribute further pedagogical knowledge to an area that has been largely neglected.

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APPENDIX A

A-1 Letter to Parents

Dear Parent,

As a doctoral student in education at the University of Ottawa, I am required to conduct a research study. Also, as a teacher with the Carleton Roman Catholic Separate School Board, I have frequently noticed that many students have difficulty understanding figurative language. Accordingly, I have decided to blend my academic studies with my teaching experience by designing a research study that will identify the strategies used by grade nine students to understand figurative language. This study has been approved by the Carleton Roman Catholic Separate School Board and by Mr. J. Starr Kelly, Principal, St. Mark's High School. This letter requests your permission to let your child participate in the study.

Students will be asked to rank a number of sentences according to how well each sentence illustrates the figurative meaning of a given proverb. Let me emphasize that the focus of the research is to learn more about strategies used by students during the task and that the purpose is not to test for right or wrong answers. The study will require thirty to fifty minutes of your child's time and a coding system will be used to ensure anonymity and confidentiality. Of course, should you be interested in the findings, I would be most happy to discuss them with you.

The results of the study will benefit teachers and students as it will increase their understanding of the strategies involved in the interpretation of figurative language, and by extension, the reading process.

I respectfully request that you complete the attached consent form and have your child return it to his or her home room teacher at St. Mark's as quickly as possible. If you have any questions, do not hesitate to call me at 224-2222.

Thank you for your anticipated co-operation.

Sincerely,

John Burton

A-2 Consent Form

Dear Parent:

Currently, Mr. John Burton is a doctoral student at the University of Ottawa. As indicated in his letter to you, he is interested in learning more about the strategies used by grade nine students to understand figurative language.

I encourage you to support Mr. Burton's research project by completing the consent form below.

Sincerely,

I.I. Dow, Ph.D.

Director of
Educational Studies

CONSENT FORM

I agree to allow my child _____ to participate in the research project being conducted by Mr. John Burton. I understand that data will be coded to ensure anonymity and that the results will be shared with me should I do desire.

_____

Parent's Signature

APPENDIX B

Episodes, Information Processing Components and Codes

ENCODING

Reads Material - (RM)

Student reads material. Includes re-reading(s) of material. Material is translated into an internal representation for further interpretation. Involves perceiving the sentence and accessing stored information that enables student to translate the material.

Relevant Information - (RI)

Student uses relevant/irrelevant semantic/syntactic information in a sentence or proverb. This information is used to determine sentence rank.

Example:

Proverb: Bees have honey in their mouths and stingers in their tails.

Sentence: Part of a whole doesn't necessarily fit all contexts or wholes.

Response of Student

And - geez. What does this have to do with a bee? Uhm. I don't know, it doesn't make any sense to me at all. This must be last.

Explanation of Process

Student reads proverb and forms a literal representation of a bee. Student then compares information from sentence to representation of proverb. Concludes that there is no match.

ANALYZING

Analogy Construction - (AC) Student uses sentence elements to construct a four term analogy (A:B::C:D). The analogy may be explicit (E) or implicit (I).

Example:

Proverb: A net with a hole in it won't catch any fish.

Sentence: A proper but faulty instrument won't help you achieve your goal.

Response of Student

Ok. Umm. The faulty instrument won't help you to achieve your goal. That makes sense! It doesn't work the faulty instrument being a net with a hole in it. Won't help you to achieve your goal - being you won't catch any fish. Number one!

Explanation of Process

Student constructs four term analogy A:B::C:D. A net with a hole in it: won't catch any fish::the faulty instrument:won't help you achieve your goal.

Key Word - (KW) Student's reasoning is developed around a single word, consequently, sentence rank is based on a single word.

Example:

Proverb: The monkey takes the chestnuts out of the fire with the dog's paw.

Sentence: The baseball player's batting average kept going down so he blamed it on the manager.

Response of Student

It's kinda tied in with these [i.e. the other sentences] but it's not really because he's blaming another person instead of using him. And, like, there's one scene here about baseball, but in the others, there's nothing else, on baseball here. The sentences are all different.

Explanation of Process

Student uses a single word to interpret meaning at the expense of an underlying theme.

Element Comparison - (EC) Student compares and relates elements from one sentence to elements in other sentences to determine rank.

Example:

Proverb: Bees have honey in their mouths and stingers in their tails.

Sentence: The star batter saved the game by scoring the winning run, but broke the team's last bat.

Response of Student

That one, I think, uhm, that has some good in it and some bad. He seemed good playing the game and stuff but he did something bad too. Like these three, it [the sentence] goes with the rest of them because they have good and bad. Can be good but there's still some bad.

Explanation of Process

Student determines rank by relating items or ideas among sentences rather than relating items between a sentence and the proverb. Students often miss overall theme.

Conceptual Figurative - (CF) Student identifies abstract relation and infers meaning from sentence to determine rank. Student integrates information across sentences to infer a common underlying theme.

Example:

Proverb: The monkey takes the chestnuts out of the fire with the dog's paw.

Sentence: People may use others for their own gain.

Response of Student

This is first because it's the closest. It's the most general of all. It indicates it's the first thing you would think of. The rest of these are all examples of this.

Explanation of Process

Student recognizes and integrates the abstract relationship that links the proverb to a sentence and that links the sentences. As well, the student recognizes that the abstract quality of the sentence makes its meaning generative.

Forced Match - (FM) — Student forces a match between a sentence and a proverb to determine sentence rank. Student creates a relation that does not exist.

Example:

Proverb: Bees have honey in their mouths and stingers in their tails.

Sentence: A part of a whole doesn't necessarily fit all contexts or wholes.

Response of Student

I think this sentence would be next because, uhm, ah, bees have a total different attitude than us and we don't realize it.

Explanation of Process

Student imposes or creates a relationship between the proverb and a sentence. Absence of a logical analysis.

Surface Processing - (SP) — Student uses literal information only to understand a proverb or sentence.

Example:

Proverb: The monkey takes the chestnuts out of the fire with the dog's paw.

Sentence: Students starts to choose a sentence but pauses.

Response of Student

First of all, I don't think, I think this is wrong because why would a monkey take the chestnuts out with a dog's paw? It doesn't mean anything.

Explanation of Process

Use of literal interpretation leads to restricted understanding. Student misses underlying theme.

Personalizes Elements - (PE) Student personalizes information and comments on element to determine rank. Student interprets sentences in isolation.

Example:

Proverb: The monkey takes the chestnuts out of the fire with the dog's paw.

Sentence: The head scientist took all the credit for the award despite the fact that his assistants had all the bright ideas.

Response of Student

If I were his assistant, uhm, I'd - I don't know - like, tell the board or whatever, whoever, judging the, ah, award or whatever because he shouldn't get all the credit. I, uhm, did it too so I should get at least half or something. It just isn't fair.

Explanation of Process

Student tends to rank sentence without regard to its relationship to a proverb. Student provides personal commentary on the literal interpretation only.

MONITORING

Checks Rank - (CR) Student checks a sentence's rank during task.

Example:

Proverb: A net with a hole in it won't catch any fish.

Sentence: The fireman's suit didn't protect him from the high temperature.

Response of Student

This one I'm not sure. Does it fit? Yeah, good, it goes, okay, this one's third.

Explanation of Process

Student selects a sentence and checks its appropriateness.

Alters Ranking - (AR) Student alters a sentence's rank after checking.

Example:

Proverb: A net with a hole in it won't catch any fish.

Sentence: The sleeping security guard didn't hear the thieves.

Replaced by:

Sentence: A proper but faulty instrument won't help you achieve your goal.

Response of Student

That might even go first, I'm not sure. I'll put that one first, change my mind because it seems to relate 'cause the net is a proper instrument but it's faulty so it won't achieve the goal of catching any fish.

Explanation of Process

Student reads a sentence(s) and uses it to change the existing rank.

Rank Not Checked - (NC) Student fails to check rank(s).

RESPONSE CATEGORY

Figurative Conceptual - (FC) Student's response demonstrates a figurative understanding; there is evidence of conceptual understanding and a conceptual base.

Example:

Proverb: Bees have honey in their mouths and stingers in their tails.

Sentence: Some things that look good on the surface may turn out to be totally bad.

Response of Student

Because I like the bee-, it looks like it has honey in its mouth, it looks nice but then when you really think about it it has a stinger and it can really hurt you, so the same thing like here it says some things look good on the surface may turn out to be totally bad.

Literal Perceptual - (LP) Student's response demonstrates a literal understanding; the sentence rank is determined by perceptual features.

Example:

Proverb: Bees have honey in their mouths and stingers in their tails.

Sentence: The summer rain drops were so heavy that they cracked the parched crops.

Response of Student

This one I don't know, it's a bit hard to believe, sort of because, I don't know, ah, raindrops aren't really that heavy.

No Match - (NM) Student is unable to match a sentence to a proverb or to other sentences.

Example:

Proverb: Bees have honey in their mouths and stingers in their tails.

Sentence: A part of a whole doesn't necessarily fit all contexts or wholes.

Response of Student

A part of a whole doesn't necessarily fit all contexts or wholes is going last 'cause I don't think it goes with anything.

Explanation of Process

Student has compared the sentence and its elements to the proverb, the sentences, and their elements but is unable to find a match.

APPENDIX C

Response Times And Scores For Low Verbal Reasoning Students

		Response Time				Score			
Student	Gender	Net	Bees	Monkey	Total	Net	Bees	Monkey	Total[a]
01	M	184	184	129	497	2	1	2	5
02	M	184	193	151	528	0	0	2	2
03	M	188	199	187	574	1	2	1	4
04	M	191	202	189	582	0	0	1	1
05	M	197	217	190	604	0	0	0	0
06	M	223	217	208	648	0	1	0	1
07	M	224	221	213	658	0	0	1	1
08	M	228	231	213	672	0	0	0	0
09	M	230	236	229	695	1	1	0	2
10	M	236	247	243	726	1	0	1	2
11	M	252	266	247	765	2	2	1	5
12	M	262	271	252	785	0	0	0	0
13	M	271	278	260	809	0	0	0	0
14	M	307	323	317	947	1	0	0	1
15	M	342	331	351	1024	0	0	1	1
16	M	369	444	365	1178	0	0	1	1
17	M	383	468	403	1254	0	2	1	3
18	M	463	607	426	1496	0	1	1	2
19	M	566	669	514	1749	1	0	0	1
20	M	678	807	723	2208	0	0	2	2
41	F	131	171	92	394	1	1	0	2
42	F	176	194	134	504	0	2	2	4

43	F	179	229	146	554	0	0	1	1
44	F	183	236	158	577	0	2	2	4
45	F	186	239	172	597	2	0	2	4
46	F	286	241	173	600	0	0	2	2
47	F	203	256	174	633	0	0	1	1
48	F	247	258	201	706	1	1	1	3
49	F	256	260	202	718	0	0	0	0
50	F	262	262	204	728	1	1	2	4
51	F	278	276	211	765	1	1	1	3
52	F	282	279	214	775	0	1	1	2
53	F	286	303	232	821	2	0	1	3
54	F	298	309	267	874	0	0	0	0
55	F	321	354	299	974	1	0	2	3
56	F	322	394	322	1038	0	1	1	2
57	F	322	418	327	1067	0	1	2	3
58	F	324	432	329	1085	1	2	1	4
59	F	384	498	366	1248	1	2	1	4
60	F	490	508	384	1382	1	2	0	3

[a] Highest possible score = 6

APPENDIX D

Response Times and Scores for High Verbal Reasoning Students

		Response Time				Score			
Student	Gender	Net	Bees	Monkey	Total	Net	Bees	Monkey	Total[a]

Student	Gender	Net	Bees	Monkey	Total	Net	Bees	Monkey	Total
21	M	106	185	106	397	1	0	2	3
22	M	135	204	142	481	1	1	2	4
23	M	138	207	145	490	1	1	2	4
24	M	185	212	147	544	1	1	1	3
25	M	186	228	167	581	2	1	1	4
26	M	192	236	199	627	0	0	2	2
27	M	208	244	202	654	1	0	2	3
28	M	208	258	205	671	2	1	2	5
29	M	215	281	220	716	1	2	1	4
30	M	239	302	242	783	0	2	2	4
31	M	268	305	248	821	1	0	1	2
32	M	274	335	249	858	2	2	2	6
33	M	278	337	249	864	0	0	2	3
34	M	282	338	251	871	1	0	2	3
35	M	286	340	276	902	1	1	1	3
36	M	298	369	284	951	1	0	2	3
37	M	310	374	294	978	2	2	1	5
38	M	319	423	336	1078	0	1	1	2
39	M	326	571	424	1321	0	2	1	4
40	M	327	808	630	1765	0	0	1	1
61	F	128	133	84	345	0	0	2	2

62	F	133	162	121	416	0	2	1	3
63	F	156	182	122	460	2	0	2	4
64	F	182	201	123	506	1	0	2	3
65	F	187	202	141	530	1	2	2	5
66	F	191	212	169	569	1	1	2	4
67	F	191	212	201	604	1	1	2	4
68	F	203	221	206	630	1	0	1	2
69	F	214	230	221	665	0	1	0	1
70	F	240	233	226	699	1	1	2	4
71	F	252	235	230	717	0	1	1	2
72	F	254	245	238	737	1	0	2	3
73	F	257	268	242	767	0	2	1	3
74	F	266	312	276	854	0	1	2	3
75	F	322	336	280	938	1	1	1	3
76	F	326	348	290	964	2	0	2	4
77	F	328	360	315	1003	2	2	2	6
78	F	334	394	361	1089	0	0	2	2
79	F	370	433	370	1173	0	1	2	3
80	F	215	434	377	1026	0	1	1	2

[a] Highest possible score = 6

APPENDIX E

Means and Standard Deviations for Group Response Times and Category Scores Across Proverb Sets

Group	ML	FL	MH	FH
Category Score				
M	1.70	2.60	3.40	3.15
SD	1.53	1.27	1.19	1.18
Response Time				
M	919.95	801.95	817.65	734.60
SD	428.97	238.24	275.46	222.69

Note. Time presented in seconds.

APPENDIX F

Means and Standard Deviations of Response Times and Category Scores per Proverb Sets by Gender and Verbal Reasoning Category

Gender	Verbal Reasoning	Statistic		Proverb Set: Net	Bees	Monkey
Male	Low	M	Time	298.90	330.55	290.50
		SD		131.55	172.93	138.52
		M	Score	.45	.50	.75
		SD		.69	.76	.72
	High	M	Time	239.00	327.85	250.80
		SD		65.96	141.49	112.84
		M	Score	.95	.90	1.55
		SD		.69	.79	.51
Female	Low	M	Time	265.80	305.85	230.30
		SD		82.65	94.07	80.37
		M	Score	.60	.85	1.15
		SD		.68	.81	.75
	High	M	Time	237.30	267.65	229.65
		SD		68.47	85.83	84.70
		M	Score	.70	.85	1.60
		SD		.73	.75	.60

Note. Time presented in seconds.

APPENDIX G

Table G.1

Information Processing Component Frequencies and Percentage Occurrences

Proverb Set 1 (Net)

Group (n=20)	ML		FL		MH		FH		Total
Code	Frequencies and (Percentage Occurrences)								
Analogy Construction (AC)	4	(2.50)	5	(3.12)	19	(11.87)	12	(7.50)	40
Key Word (KW)	12	(7.50)	11	(6.87)	8	(5.00)	7	(4.38)	38
Element Comparison (EC)	11	(6.87)	32	(20.00)	65	(40.62)	35	(21.88)	143
Conceptual Figurative (CF)					1	(0.63)	1	(0.63)	2
Forced Match (FM)	2	(1.25)	9	(5.62)	8	(5.00)	14	(8.75)	33
Surface Processing (SP)	59	(36.87)	9	(5.62)	9	(5.62)	17	(10.63)	94
Personalizes Elements (PE)	17	(10.62)	35	(21.87)	31	(19.37)	3	(1.87)	86
Code Combinations									
KW + EC			2	(1.25)	1	(0.62)	3	(1.87)	6
KW + FM									
KW + SP			1	(0.63)	1	(0.63)			2
KW + PE			1	(0.63)			1	(0.63)	2
KW + EC + FM	1	(1.25)							1
KW + EC + SP							1	(0.63)	1
KW + EC + PE									
KW + SP + PE									
EC + FM			1	(0.63)			2	(1.25)	3
EC + SP	15	(9.37)	10	(6.25)	5	(3.12)	12	(7.50)	42
EC + PE			5	(3.12)			8	(5.00)	13
EC + FM + SP									
EC + FM + PE									
EC + FM + SP + PE									
EC + SP + PE							1	(0.63)	1
FM + SP					2	(1.25)	10	(6.25)	12
FM + PE			3	(1.87)	1	(0.63)	5	(3.13)	9
FM + SP + PE	14	(8.75)	7	(4.37)			8	(5.00)	29
SP + PE	25	(15.62)	29	(18.12)	9	(5.62)	20	(12.50)	83
Total	160 (100)		160 (100)		160(100)		160 (100)		

Table G-2

Information Processing Component Frequencies and Percentage Occurrences

Proverb Set 2 (Bees)

Group (n=20)	ML	FL	MH	FH	Total
Code	Frequencies and (Percentage Occurrences)				
Analogy Construction (AC)	3 (1.88)	5 (3.12)	25 (15.63)	24 (15.00)	57
Key Word (KW)	1 (0.63)	2 (1.25)	3 (1.88)	1 (0.63)	7
Element Comparison (EC)	23 (14.38)	41 (25.63)	60 (37.50)	57 (35.63)	181
Conceptual Figurative (CF)			2 (1.25)	1 (0.63)	3
Forced Match (FM)	1 (0.63)	9 (5.63)	12 (7.50)	5 (3.13)	27
Surface Processing (SP)	59 (36.88)	13 (8.13)	17 (10.63)	8 (5.00)	97
Personalizes Elements (PE)	15 (9.38)	50 (31.25)	14 (8.75)	18 (11.25)	97
Code Combinations					
KW + EC				1 (0.63)	1
KW + FM	7 (4.83)		1 (0.63)		8
KW + SP	3 (1.88)				3
KW + PE					
KW + EC + FM					
KW + EC + SP					
KW + EC + PE					
KW + SP + PE					
EC + FM		4 (2.50)	1 (0.63)	2 (1.25)	7
EC + SP	12 (7.50)	7 (4.38)		12 (7.50)	31
EC + PE	2 (1.25)	3 (1.88)	15 (9.38)	11 (6.88)	31
EC + FM + SP		2 (1.25)			2
EC + FM + PE	1 (0.63)				1
EC + FM + SP + PE					
EC + SP + PE	1 (0.63)				1
FM + SP	1 (0.63)	3 (1.88)	2 (1.25)	2 (1.25)	8
FM + PE	10 (6.25)	1 (0.63)	2 (1.25)	2 (1.25)	15
FM + SP + PE				1 (0.63)	1
SP + PE	21 (13.13)	20 (12.50)	6 (3.75)	15 (9.38)	62
Total	160 (100)	160 (100)	160 (100)	160 (100)	

Table G-3

Information Processing Component Frequencies and Percentage Occurrences

Proverb Set 3 (Monkey)

Group (n=20)	ML	FL	MH	FH	Total
Code	Frequencies and (Percentage Occurrences)				
Analogy Construction (AC)	4 (2.50)	5 (3.12)	26 (16.25)	11 (6.88)	46
Key Word (KW)	30 (18.75)	22 (13.75)	35 (21.88)	42 (26.25)	129
Element Comparison (EC)	11 (6.88)	61 (38.13)	58 (36.25)	54 (33.75)	184
Conceptual Figurative (CF)			4 (2.50)	5 (3.13)	9
Forced Match (FM)	3 (1.88)	4 (2.50)	5 (3.13)	7 (4.83)	19
Surface Processing (SP)	37 (23.13)	1 (0.63)	7 (4.83)	3 (1.88)	48
Personalizes Elements (PE)	16 (10.00)	40 (25.00)	4 (2.50)	3 (1.88)	63
Code Combinations					
KW + EC		1 (0.63)	11 (6.88)	6 (3.75)	18
KW + FM		1 (0.63)			1
KW + SP					
KW + PE	1 (0.63)	3 (1.88)	1 (0.63)	1 (0.63)	6
KW + EC + FM	6 (3.75)				6
KW + EC + SP					
KW + EC + PE			1 (0.63)		1
KW + SP + PE			1 (0.63)		1
EC + FM		1 (0.63)			1
EC + SP		1 (0.63)			1
EC + PE	1 (0.63)		1 (0.63)	12 (7.50)	14
EC + FM + SP					
EC + FM + PE					
EC + FM + SP + PE		4 (2.50)			4
EC + SP + PE				1 (0.63)	1
FM + SP		4 (2.50)			4
FM + PE		1 (0.63)	6 (3.75)	1 (0.63)	8
FM + SP + PE	9 (5.63)			1 (0.63)	10
SP + PE	42 (26.25)	11 (6.88)		13 (8.13)	66
Total	160 (100)	160 (100)	160 (100)	160 (100)	

APPENDIX H

Degree of Association Between Combinations of Proverb Sets and Groups of Students for Frequency of Component Element Comparison

Proverb Set	Group of Students	x^2	df	p
All (3)	All (4)	16.37	6	.0119*
All (3)	ML + MH and FL + FH	8.07	2	.0176*
All (3)	ML + FL and MH + FH	2.90	2	.2339
All (3)	MH and FH	5.12	2	.0757
All (3)	ML and FL	7.69	2	.0211*
All (3)	ML and MH	5.29	2	.0697
All (3)	FL and FH	2.66	2	.2634
Net + Bees	All (4)	6.49	3	.0914
Net + Monkey	All (4)	8.49	3	.0366*
Bees + Monkey	All (4)	8.25	3	.0408*
Net + Monkey	ML + MH and FL + FH	7.98	1	.0051*
Net + Monkey	ML + FL and MH + FH	2.90	1	.0851
Net + Monkey	MH and FH	3.79	1	.0489*
Net + Monkey	ML and FL	1.85	1	.1708
Net + Monkey	ML and MH	.06	1	.8011
Net + Monkey	FL and FH	.47	1	.5009
Bees + Monkey	ML + MH and FL + FH	2.62	1	.1016
Bees + Monkey	ML + FL and MH + FH	.55	1	.5369

* $p \leq .05$

APPENDIX I

Degree of Association Between Combinations of Proverb Sets and Groups of Students for Frequency of Component Personalizes Elements

Proverb Set	Group of Students	x^2	df	p
All (3)	All (4)	36.96	6	.0000*
All (3)	ML + MH and FL + FH	14.91	2	.0009*
All (3)	ML + FL and MH + FH	14.92	2	.0009*
All (3)	MH and FH	17.15	2	.0004*
All (3)	ML and FL	1.36	2	.0887
All (3)	ML and MH	11.31	2	.0040*
All (3)	FL and FH	9.95	2	.0073*
Net + Bees	All (4)	19.32	3	.0005*
Net + Monkey	All (4)	18.07	3	.0007*
Bees + Monkey	All (4)	10.67	3	.0139*
Net + Bees	ML + MH and FL + FH	12.56	1	.0007*
Net + Bees	ML + FL and MH + FH	.85	1	.6396
Net + Bees	ML and FL	1.34	1	.2449
Net + Bees	MH and FH	17.09	1	.0002*
Net + Bees	ML and MH	1.98	1	.1559
Net + Bees	FL and FH	5.29	1	.0203*
Net + Monkey	ML + MH and FL + FH	8.49	1	.0040*
Net + Monkey	ML + FL and MH + FH	14.73	1	.0003*
Net + Monkey	MH and FH	5.38	1	.0194*
Net + Monkey	ML and FL	.22	1	.6476
Net + Monkey	ML and MH	11.23	1	.0012*
Net + Monkey	FL and FH	.02	1	.8695
Bees + Monkey	ML + MH and FL + FH	.06	1	.7998
Bees + Monkey	ML + FL and MH + FH	9.92	1	.0021*
Bees + Monkey	ML and FL	.48	1	.5026
Bees + Monkey	MH and FH	.41	1	.5271
Bees + Monkey	ML and MH	4.07	1	.0412*
Bees + Monkey	FL and FH	6.53	1	.0105*

* $p \leq .05$

APPENDIX J

Degree of Association Between Combinations of Proverb Sets and Groups of Students for Frequency of Component Surface Processing

Proverb Set	Group of Students	x^2	df	p
All (3)	All (4)	13.38	6	.0374*
All (3)	ML + MH and FL + FH	7.08	2	.1721
All (3)	ML + FL and MH + FH	1.04	2	.6002
All (3)	MH and FH	6.94	2	.0305*
All (3)	ML and FL	5.27	2	.0703
All (3)	ML and MH	2.18	2	.3379
All (3)	FL and FH	4.20	2	.1206
Net + Bees	All (4)	6.38	3	.0936
Net + Monkey	All (4)	7.36	3	.0606
Bees + Monkey	All (4)	5.88	3	.1168

* $p \leq .05$

APPENDIX K

Degree of Association Between Combinations of Proverb Sets and Groups of Students for Frequency of Component Surface Processing and Personalizes Elements

Proverb Set	Group of Students	x^2	df	p
All (3)	All (4)	23.25	6	.0007*
All (3)	ML + MH and FL + FH	8.54	2	.0141*
All (3)	ML + FL and MH + FH	4.75	2	.0912
All (3)	MH and FH	5.16	2	.0743
All (3)	ML and FL	13.64	2	.0015*
All (3)	ML and MH	12.31	2	.0026*
All (3)	FL and FH	1.22	2	.5499
Net + Bees	All (4)	.2797	3	.9629
Net + Monkey	All (4)	21.24	3	.0003*
Bees + Monkey	All (4)	15.65	3	.0018*
Net + Monkey	ML + MH and FL + FH	7.56	1	.0062*
Net + Monkey	ML + FL and MH + FH	.422	1	.0377*
Net + Monkey	MH and FH	5.13	1	.0222*
Net + Monkey	ML and FL	12.41	1	.0008*
Net + Monkey	ML and MH	12.61	1	.0007*
Net + Monkey	FL and FH	1.16	1	.2816
Bees + Monkey	ML + MH and FL + FH	5.19	1	.0215*
Bees + Monkey	ML + FL and MH + FH	3.29	1	.0663
Bees + Monkey	ML and FL	8.21	1	.0045*
Bees + Monkey	MH and FH	4.51	1	.0318*
Bees + Monkey	ML and MH	10.22	1	.0018*
Bees + Monkey	FL and FH	.73	1	.6025

* $p \leq .05$

Coding Form for Recording Information Processing Components in Verbal Protocols

COMPONENTS OF INFORMATION PROCESSING

Proverb Set: _____
Student Code: _____
VR Score: _____
AR Score: _____
Group: _____

Sentence Rank		Encoding		Analyzing							Monitoring			Response Category		
Standard	Student's	RM	RI	AC	KW	EC	CF	FM	SP	PE	CR	AR	NC	FC	LP	NM
1																
2																
3																
4																
5																
6																
7																
8																
Totals:																