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Pupil understanding of connectives in reading

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INVESTIGATES STUDENTS' fourth-, fifth-, and sixth-grade reading comprehension of connectives. The study was carried out in three sections: 1] identification of various types of connectives and the kind of sentence structures in which they appear; 2] construction of a Connectives Reading Test; and, 3] analysis of results of Connectives Reading Test. Results showed that, for each grade group tested, there was an increase in pupil understanding of the items of the Connectives Reading Test and of each of 17 selected connectives, from a lower to a higher grade. Within each grade, at least five achievement groups were identified whose group means on the Connectives Reading Test differed significantly one from the other. Other findings indicated that, by connective class, comprehension problems appeared to focus on the test items containing sentence linkers. Of the 17 individual connectives, student comprehension of the items testing six connectives, *however*, *thus*, *which*, *although*, and *yet* were below the comprehension level of the total student group on all test items. A significant relationship was found between the understanding a child has of connectives and his sex, mental age, and abilities in listening, reading, and written language. Place of residence in urban, small town, or rural areas exerted a significant effect upon pupil test scores interacting significantly with both grade and sex factors.

Compréhension des conjonctions en lecture

DESCRIPTION D'UN SONDAGE sur la compréhension des conjonctions en quatrième, cinquième, et sixième années de lecture. L'étude comprend trois sections: 1] Identification des différents types de conjonctions et du genre de constructions grammaticales des phrases dans lesquelles elles apparaissent. 2] Construction d'un Test de Lecture de Conjonctions. 3] Analyse des résultats du Test de Lecture de Conjonctions. Les résultats montrent que, considérant chaque classe dans sa totalité, la compréhension des différentes parties du Test de Lecture de Conjonctions et des 17 conjonctions choisies croît de la quatrième à la sixième années. Dans chaque classe, on peut identifier au moins cinq groupes

This doctoral investigation was conducted under the direction of Dr. Marion D. Jenkinson, formerly at the University of Alberta, now at the Ontario Institute for Studies in Education.

différents dont les moyennes obtenues au Test de Lecture de Conjonctions présentent des différences significatives. On trouve aussi que, considérant chaque classe de conjonctions, les plus grandes difficultés de compréhension pour les élèves semblent être concentrées sur les parties du Test qui contiennent des conjonctions de coordination entre phrases. Pour les 17 conjonctions utilisées dans le Test, la compréhension par les élèves de la partie du test contenant les 6 conjonctions, *however* (cependant), *thus* (ainsi), *which* (que), *although* (quoique), et *yet* (encore), était inférieure au niveau général de compréhension par tous les élèves de toutes les parties du Test. Il y a un coefficient de corrélation élevé entre la compréhension des conjonctions par un enfant et son sexe, son âge mental, et la façon dont il sait écouter, lire et utiliser le langage écrit. L'endroit où il habite dans une grande ville, une petite ville, ou à campagne, exerce une influence importante sur le score qu'il obtient au test, influence qui s'ajoute et se mêle d'une façon significative aux facteurs sexe et classe.

Compresión de conjuntivos en la lectura por parte del alumno

INVESTIGA LA comprensión de conjuntivos en la lectura por parte de alumnos de cuarto, quinto y sexto grados. El estudio se realizó en tres secciones: 1] Identificación de varios tipos de conjuntivos y la clase de estructura de la oración en que aparecen; 2] Construcción de la *Prueba de Lectura de Conjuntivos*; y 3] Análisis de los resultados de la *Prueba de Lectura de Conjuntivos*. Los resultados revelaron, que en cada grupo de grado investigado de bajos a altos, hubo un aumento en las comprensión por parte del alumno, de los artículos de la *Prueba de Lectura de Conjuntivos* y de cada uno de los 17 conjuntivos seleccionados. Dentro de cada grado, se identificaron por lo menos cinco grupos, en términos de rendimiento, cuya media de grupo en la *Prueba de Lectura de Conjuntivos* varió significativamente de unos a otros. Otros descubrimientos indicaron que por clase conjuntiva, los problemas de comprensión aparecían concentrados en los artículos de la prueba que contenían enlaces de oraciones. De los 17 conjuntivos individuales, la comprensión de los artículos en los cuales se probaron seis conjuntivos, *sin embargo*, *así*, *que*, *aunque* y *todavía* fue inferior al nivel de comprensión del grupo total de estudiantes en todos los artículos de la prueba. Se encontró una relación significativa entre sexo, edad mental, y habilidad para escuchar, leer y escribir el idioma por parte del niño y su comprensión de conjuntivos. El sitio de residencia, urbana, población pequeña o zona rural tuvo, un efecto significativo en los puntajes de la prueba interactuando significativamente con factores tanto de sexo como de grado.

Students in the upper elementary grades are often required to read sentences which have coordinate and subordinate ideas in them, but very little is known about the problems which these sentence structures may present to them in reading. This study, therefore, investigates children's understanding of connectives—the linguistic forms that connect a clause to another clause or some word in it on the printed page. Subjects were children aged eight to twelve studying in grades four to six.

Although there are a number of ways of associating ideas in English, connectives are used widely. Many investigations of clauses children use in their speech and writing have been made, but very little research has concentrated on the connectives of the clauses. The concern many felt was voiced by Smith (1963, p. 18): "One wonders whether over-emphasis upon subject and predicate, which appear in both the clause and the sentence as a whole, and too little attention to the meaning signaled by the connective may cause the difficulty."

Early in the twentieth century, writers (Huey, 1912; Thorndike, 1917) drew attention to problems connectives pose; while, in more recent years, others (Flesch, 1946; Squire, 1963; Gates, 1947) have written about the complexity of conjunctions questioning children's understanding and use of them.

The nature and function of connectives were reviewed in historical perspective by Vorlat (1963) and Earle (1871) and in modern linguistic setting by Gleason (1965) and Sledd (1959). Connectives, in addition to joining the words of clauses, express the nature of the connection as in condition, concession, and cause; while other words, such as pronouns, coexist with the connectives to associate one clause to another. As the language changes, new connectives, such as *like*, are being admitted and others, such as *thus*, are reserved increasingly for the more formal language of print. Watts (1944) and Gleason (1965) discussed various clause constructions in the formal and informal varieties of the same language. Ruddell (1963) investigated the effects of the similarity of oral and written patterns of language structure on reading comprehension of students.

Many investigators have studied the language children speak or write, thus providing insight into reasons why children fail to comprehend what others have written for them. Harrell (1957) and Davis (1937) reported that the subordination in the language of children aged eight to twelve was ten to thirty per cent of the total

number of sentences they used and that the amount increased from year to year. The types of clauses children used, the position of the clauses in sentences, clause length and complexity, as well as children's memory for clauses are all areas investigated by researchers. Factors affecting reading achievement, chronological age, mental ability, language ability, and socio-economic status were noted also.

As the investigation reported here focused on the understanding children have of connectives in reading, some contributions to knowledge of the close relationship among language, thought, and reading and the place of connectives in that relationship as revealed in the writings of Piaget (1926, 1928), Vygotsky (1934), and Osgood (1937) are relevant.

Piaget (1926, 1928) reported that children communicated freely with their environment through language. By listening to spoken words (and later through the reading process also) children were able to take in information about the world, past, present, and future. Their inner mental maneuvers freely made use of language to manipulate learnings, to make associations, and to complete logical deductions. In accommodating to the environment, too, Piaget believed that children continuously used language. From his observations, Piaget learned that children used connectives in speech before they grasped the structures of meaning corresponding to the syntactic forms they used. That is, the grammar preceded the logic.

Vygotsky (1934, pp. 126-27) corroborated the findings of Piaget indicating that children acquired the structures of oral language through imitation of elders and peers. Later they became more aware of meanings which others attributed to words and incorporated them into their repertoire of word meanings.

Osgood (1957) posed a theory of learning comprising a two stage model with three levels of organization at each stage. He then described the reading process in terms of his model. Understanding connectives would be an example of the first stage, decoding, the process whereby an individual transforms the physical energies of the environment into perceptions. The three levels are projection, integration, and representation. At the projection level, sensory visual stimuli from the printed page are relayed to the brain, but no learning takes place. At the next stage, the minimal units in language decoding, the phonemes, are organized and grouped in sequences with much learning capable of going on through the building up of integrations and integrational hierarchies of alternatives (syntactical).

In the highest stage, representation, decoding operations are terminated in the mediation of meaning units followed by an initiation of encoding, the total process whereby the intentions of an organism are expressed and are turned into environmental events. This stage, if reached in reading, would represent the assimilation of reading material with a resultant change in the behavior of the reader.

To accommodate to problems of the formal language of print which require children to code on various levels in order to grasp the levels of meaning, Osgood's model would have to allow for different representational levels. However, the model does indicate the close association among language, thought, and reading.

In school, children are forced to read books written by adults who very often use more mature language structures and thinking processes than those same children can understand. The structural patterns of these printed materials contain ideas which are linked coordinately or subordinately to other ideas by the linguistic unit called a connective. Any control over the use of these complex sentence patterns in school texts does not appear to extend beyond the first few years in school. The result is an imposing array of reading materials both in the basal developmental reading program and in the functional and recreational reading programs. Although there are many factors contributing to reading problems, one factor may be the lack of understanding of connectives.

The present investigation was conducted in three stages. In Stage I, the content of basal readers was analyzed to identify the connectives used and the type of sentence structures in which they were often found; in Stage II, multiple-choice test items were constructed containing selected connectives in sentence structures of basal readers; and, in Stage III, the test was administered and the data collected were processed according to selected statistical techniques. In this article, the main hypotheses and definition of selected terms are summarized, each stage of the investigation is described briefly, and some of the main findings, conclusions, and implications are presented.

Hypotheses

The following null hypotheses were tested by selected statistical procedures:

Hypothesis I There is no significant relationship between the understanding a child has of connectives and: a] sex, b] mental age, c] chronological age, d] socio-economic status, e] listening ability, f] reading ability, g] written language ability.

Hypotheses II to V depend upon the statistical control of the seven variables listed in Hypothesis I.

Hypothesis II There is no significant increase in the pupil's understanding of connectives from grade four to grade five and from grade five to grade six. This development of understanding can be identified by a statistically significant increase in the total number of correct answers attained by the pupils from grades four, to five, to six on the Connectives Reading Test.

Hypothesis III There is no significant difference in the rate of development of pupils' understanding of different connectives. That is, if the rate of development is not uniform for different connectives, the percentage of correct answers of pupils on the Connectives Reading Test from one grade to another should vary with the connective.

Hypothesis IV There is no significant variation in the pupils' understanding of a connective within each grade. The variation in pupils' understanding of a connective can be identified as student achievement groups in which the percentage of correct answers of one group on the Connectives Reading Test is significantly different from that of another group for a connective on the same test.

Hypothesis V There is no significant relationship between the pupil's understanding of a connective and the type of errors he makes as he reads. No error on a test item of the Connectives Reading Test indicates an understanding of the connective, while a grammatical or situational error should indicate a partial understanding of that connective. A wrong connective answer indicates no understanding.

A number of other related aspects were investigated less formally as opportunities permitted. Among these were: 1] the spatial position of the connective in the sentence; 2] sentence length; 3] clause length; 4] the use of a connective in combination with other connectives; and 5] presence in the sentences of passive voice, negation, phrases, verbals, and adjectives.

Definition of terms

In this study, *understanding*, or comprehension, was defined as the process in reading by which the reader makes sense out of the message on the printed page. Understanding was measured by the reader's ability to choose the right answer in the multiple-choice reading test. Lack of understanding was indicated by choosing the wrong answer although two stages of development towards understanding were recognized by the choice of answers in which there were grammatical or situational errors.

A *sentence* in this study was a word or group of words on the printed page which is bounded by a capital letter at the beginning and a period, question mark, or exclamation mark at the end. The sentence could be a clause; the clause could be a sentence. Since the research instrument was a multiple-choice test, one of the four suggested answers in an item had to be chosen by the student if that test item was to be considered as a possible sentence.

A *clause* was defined as a group of words on the printed page which had a finite verb and which was linked to a word or group of words by a connective. A finite verb was any verb except an infinitive, present participle, or past participle used by itself or in combination with one another. By themselves, these three verb forms were not finite verbs, although they could be part of finite verb-phrases. In this study, a group of words containing a finite verb which could be connected to another word or group of words by the connective *that*¹ was also considered to be a clause.

A *connective* was defined as a linguistic form that linked a clause to another clause or to some word in the other clause. Each connective appeared to be a semantic link basic to the understanding of meaning. Two forms of connectives were identified: one-word connectives and phrasal connectives. The phrasal connectives represented only 6.24 per cent of the total number of connectives found in the basal reader sentence analysis; thus, they were not investigated. The one word connectives were divided into two groups: 1] those which connected group of words within a sentence, and 2] those which connected sentences. Table 1 summarizes these forms.

Those connectives which link clauses to words or groups of words within a sentence fell into two classes: subordinate clause connectives and coordinate clause connectives. The subordinate clause

1. See absent connective below.

connectives are those attached to clauses which function in sentences as nouns, adjectives, or adverbs. That is, the clause to which these connectives are attached are subordinate to another clause in the

Table 1 Summary of the connective forms: groups and classes of the one-word connectives

<i>Connective forms and groups of connectives</i>	<i>Classes of connectives</i>	<i>Sub-classes of connectives and names of connectives investigated in study</i>
Connective is present in graphic form.		
I. Connectives connecting a clause to another clause or some word in it on the printed page.	A. Subordinate clause connectives	1. Simple includer: —although, because, if, so, that, when, where.
	B. Coordinate clause connectives	2. Relative pronoun: —that, which, who. —and, but, for, yet.
II. Those connecting one sentence with another.		—however, thus.
Connective is not present in graphic form but the connective “that” could be appropriately inserted.	Subordinate clause connective	“absent:” “that”

sentence. In the present study, these connectives formed two sub-classes: simple includer and relative pronoun connectives. The connectives which have no other function in the particular group of words than that of introducing the words of the clause composed the first sub-class; those with an additional function in the clause, the second sub-class. For example, in the sentence, *He saw that the boy who rode the horse was ill*, *that* is a simple includer subordinate clause connective whose only function is to introduce the subordinate clause *that the boy who rode the horse was ill*. However, *who* acts as subject of the subordinate clause in addition to introducing the subordinate clause *who rode the horse*.

The coordinate clause connectives link clauses which do not function within the sentence as a noun, adjective, or adverb. In *He held the rod and the horse jumped over it*, the two clauses linked by *and* are not subordinate one to the other.

A special case of subordinate clause connectives is that of

one-word connectives which are absent from the sentence although the words being connected are present. For example, in the sentence *The horse the boy was riding won the race*, the words *the boy was riding* is connected to *the horse won the race*, but the connective is not present. The word *that* is one word that could be acceptably used as a connective in the sentence, but it is absent. This construction was included in the investigation to determine if the absence of the connective hindered students' understanding in reading. As the connective is absent and, therefore, without form, it appeared in Table 1 as a special case of the Group 1, Class A, one-word connectives.

The linguistic forms which connect one sentence with another and which had no function as noun or adjective in the sentence formed a group called Sentence Linkers. In the sentences, *As the boat moved out of the range of one station, it came into the range of the next station. Thus the boat could remain in contact with land for the entire voyage*, the word *thus* links the two sentences.

Analysis of sentences of selected basal readers

To substantiate the choice of connectives for the present study and their use in sentences of particular structures, sentences from every twentieth page of each student text for grades four, five, and six in three selected basal reader series were analyzed. The three series chosen for the present study were: the *Winston Basic Readers*, (Stauffer, Burrows, & Jones, 1961), part of a new inclusive language arts communication program; the *New Basic Readers* (Gray, *et al.*, Canadian Edition, n.d.), a widely used series with a broad selection of stories; and the *Canadian Parade Readers* (Dickie, *et al.*, 1954), a series which presents a definite impression of ideals of Canadian way of life and which is authorized for use in many provinces across Canada.

Table 2 indicates that more than one-third of the sentences in the sentence sample contained connectives. Three-quarters of these sentences had one connective, while the remaining one-quarter contained at least two connectives. The variation in the percentage of sentences containing connectives was almost negligible from grade to grade: only two per cent more of sentences in grade four contained single connectives than did sentences in grades five and six. Other investigators (LaBrant, 1933; Watts, 1944) have consistently reported that, in both oral and written language, children showed a significant

Table 2 Distribution of connectives in sentence sample by grade and by reader series^a

Grade	Reader series	Total number of sentences in sample	Sentences with connectives		Sentences with one connective only		Sentences with more than one connective	
			No.	Per cent	No.	Per cent	No.	Per cent
4	A ^b	364	139	38.19	113	81.29	26	18.71
	B	263	98	37.26	78	79.59	20	20.41
	C	253	98	38.74	66	67.35	32	32.65
	Total	880	335	38.07	257	76.72	78	23.28
5	A	164	67	40.85	54	80.60	13	19.40
	B	309	117	37.86	92	78.63	25	21.37
	C	366	121	33.06	82	67.77	39	32.23
	Total	839	305	36.35	228	74.75	77	25.25
6	A	213	60	28.17	54	90.00	6	10.00
	B	277	125	45.13	96	76.80	29	23.20
	C	378	132	35.11	86	65.15	46	34.85
	Total	868	317	36.52	236	74.45	81	25.55
Totals by grades and series		2,587	957	36.99	721	75.34	236	24.66
Series A		741	266	35.90	221	83.08	45	16.92
Series B		849	340	40.05	266	78.24	74	21.76
Series C		997	351	35.21	234	66.67	117	33.33

^a "Absent" connectives are included in the connective counts and in the calculations of the percentages in tables 2 and 3.

^b Series A is the *Winston Basic Readers*; Series B, the *New Basic Readers*; Series C, the *Canadian Parade Readers*.

increase in their use of sentences containing connectives as their chronological age increased. Adults writing readers for children did not appear to take this into account, as the number of connectives in sentences varied little from grade to grade.

Although the *Winston Basic Readers* and the *Canadian Parade Readers* had almost the same percentage of sentences with connectives, the *Winston Basic Readers* had more one-connective sentences and fewer multi-connective sentences than the *Canadian Parade Readers*. As students in the present study did develop in their understanding of the connectives tested, the *Canadian Parade Readers* may present more reading difficulties than either of the other two series, and the *Winston Basic Readers* may be a little easier.

If joining ideas together with connectives is one way of increasing complexity in sentence structure, one would expect that, in a basal reader series, the percentage of connectives would increase from grade to grade. Only in one series was this so. It also is reasonable to

expect that, in the sentences with connectives, the one-connective sentences would decrease in favor of a proportionate rise in the number of multi-connective sentences. Such was the case in a very limited way in two of the three basal reader series.

Table 3 Distribution of forms of connectives in sentences containing one connective by grade and by reader series

Grade	Reader series	Sentences with one connective	One connective sentences with a:					
			One-word connective		Phrasal connective		Absent connective	
			No.	Per cent	No.	Per cent	No.	Per cent
4	A	113	75	66.37	9	7.97	29	25.66
	B	78	64	82.05	4	5.13	10	12.82
	C	66	55	83.33	5	7.58	6	9.09
	Total	257	194	75.49	18	7.00	45	17.51
5	A	54	47	87.04	2	3.70	5	9.26
	B	92	81	88.04	4	4.35	7	7.61
	C	82	69	84.15	0	0.00	13	15.85
	Total	228	197	86.40	6	2.63	25	10.97
6	A	54	49	90.74	1	1.85	4	7.41
	B	96	84	87.50	5	5.21	7	7.29
	C	86	63	73.26	15	17.44	8	9.30
	Total	236	196	83.05	21	8.90	19	8.05
Totals by grades and series		721	587	81.42	45	6.24	89	12.34
Series A		221	171	77.38	12	5.43	38	17.19
Series B		266	229	86.09	13	4.89	24	9.02
Series C		234	187	79.91	20	8.55	27	11.54

The distribution of forms of connectives in sentences containing one connective, two connectives, three connectives, and then four or more connectives by grade and by reader series was determined. Table 3 reviews the distribution of the one-connective sentences¹ revealing that 81.42 per cent of the one-connective sentences contained one-word connectives, 6.24 per cent contained phrasal connectives, and 12.34 per cent, *absent* connectives. *Absent* connectives were concentrated at grade four and decreased steadily at each higher grade level. If students find the comprehension of groups of words difficult when the connective is absent, they are faced with the greatest percentage of them at the lowest grade level. No consistent pattern of distribution was evident among the phrasal connectives.

1. One-connective sentences composed 75 per cent of total sentences with connectives.

Forty-two connectives were identified by name; their frequencies varied from nearly 14 per cent to less than 1 per cent of the total number of connectives found in the sentence analysis. No consistent pattern of distribution for a particular connective was discernible by grade level or by reader series. Writers of these readers appear to have given no thought to the introduction of certain connectives at various stages with subsequent provision of opportunity for development in the skill of reading them.

From the 42 connectives identified, 17 were chosen for further study (see Table 1). The choice was influenced by a number of factors among which were: the frequency of occurrence in the basal reader sentence analysis, the multiplicity of meanings the connectives had, the homographs of the connectives, the findings of previously published research, and the classes to which the connectives belonged. Sentences containing the 17 selected connectives were then analyzed. Each sentence was divided into three sections: the noun phrase (the subject and all of its modifiers), the verb phrase (the verb and its modifiers and the object or complement and its modifiers), and the sentence modifier. Each of the three sections of a sentence was further divided. For example, the noun phrase could be further shown to have determiners, single word modifiers, head words of the noun phrase, and modifying phrases and clauses. After this primary breakdown of the three sections of a sentence, each clause in that sentence was analyzed by the same procedure. The sentences of the sample were analyzed in order of frequency of occurrence of the connectives, starting with those with the lowest frequency. Thus, the low frequency connectives were given priority in the analysis of sentences with two or more connectives. The result was a more representative sample of sentences containing low frequency connectives.

At the conclusion of the sentence analysis, an attempt was made to identify sentence patterns which could be used as the basis for an item on the reading test, the research instrument. Patterns emerged in different ways with position of the clause and the persistent use of particular structural features such as adverb and adjective phrases, helping to identify them. Since the English language is so flexible, a wide variety of sentence patterns were found. However, when a pattern occurred in about one-third or more of the total number of sentences containing that connective, that pattern was considered in the final formulation of test items. In many in-

stances, clearly defined patterns did emerge and, although no binding and exacting measure could be applied to their identification and formulation, the analysis of the sentences did enable test items to be chosen which were patterned after sentences children read in the basal series. In many cases, one of the reader sentences was extracted in its entirety from the book with only a vocabulary adjustment where necessary.

The construction of the Connectives Reading Test

The first draft of the Connectives Reading Test had 199 test items and was constructed using information from the analysis of sentences containing the 17 selected connectives.

The construction of any one test item followed a set procedure. The sentence chosen as a result of the sentence analysis was written down up to and including the connective being tested. The rest of the clause which this connective introduced was written below the sentence as the alternative answer (a). A space of uniform length was left in the sentence for the insertion of the answer by the student, and then any remaining portion of the sentence was written down. This alternative answer (a), the correct answer, would reveal that the student had a good understanding of the connective as there was a smooth connection of meaning from the clause to the rest of the sentence.

The task of constructing the other three alternative answers (b), (c), and (d) was then undertaken. Each answer was to be wrong and each was to contain a different type of error. The second alternative answer (b) used the connective correctly giving the same smooth transition of meaning to the sentence as the correct answer, but incorporating a grammatical error of some type, perhaps an error in verb form, a mistake in agreement of subject and verb, or the incorrect use of a pronoun. The third alternative answer (c) also endeavored to use the connective correctly, but the situation expressed in the clause did not make sense in the context of the sentence. This proved the most difficult task of item construction since many situations made sense in context, especially to the alert pupil, while those situations so far removed from reality that they bordered on the ludicrous, obviously made no sense in context and, therefore, were no real test of pupil comprehension. The fourth and last alternative to the test item (d) was predicated on the use of an entirely different con-

nective than the one being tested in the item. The summary table below, Table 4, shows the design of an individual test item.

Table 4 The structure of an individual test item

<i>Answers given in one test item</i>	<i>Connective fits the meaning of the sentence</i>	<i>Answer is grammatical</i>	<i>Answer makes sense in context</i>
(a) Correct answer	yes	yes	yes
(b) Incorrect answer	yes	no	yes
(c) Incorrect answer	yes	yes	no
(d) Incorrect answer	no	yes	may or may not

The answers to the four choices within each test item were then randomized using a table of random numbers.

A vocabulary control in which only the first 5,000 words from the Thorndike and Lorge list (1959) were used, placed the grade level of difficulty at approximately mid-point in grade five.

Pilot study

A pilot study for the assessment of the reliability and validity of the 199 test items was conducted with 112 children in grades four, five, and six in an urban school where a wide range of socio-economic backgrounds and mental maturity scores were assured. A post-testing session was held two weeks later.

The final draft of the reading test consisted of 150 multiple-choice items selected from the 199 test items. Of the 150 test items, 85 were single-connective items and 65 were multi-connective items. With the exception of the connectives *thus* and *that* (simple includer), each connective was tested a minimum of eight times—not less than four times in single connective items and not less than three times in multi-connective items.

The reading test was untimed and the students were allowed to work until all or nearly all of them had finished. This Connectives Reading Test was administered in the study to 402 children in grades four, five, and six. Test instructions followed those of the Sequential Tests of Educational Progress (STEP) providing uniformity for the battery of STEP Reading, Writing, and Listening Tests also administered in the study.

Table 5 reports the Kuder-Richardson reliability coefficients, formula 20, for both the pilot study and the present study indicating that the test items did have high intercorrelations with each other

Table 5 Reliability of Connectives Reading Test

Pilot study (199 test items)		Kuder-Richardson formula 20
Post-test	grades 4 - 6	0.984
Pre-test	grades 4 - 6	0.991
Main study (150 items)		
Test	grades 4 - 6	0.968
Test	grade 4 only	0.966
Test	grade 5 only	0.974
Test	grade 6 only	0.962

and that they appeared to be measures of pupil understanding of connectives in reading. Since the items had been constructed from the actual sentences in the readers, there appears to be no question of content validity. In the analysis of the test results from the study, an attempt was made to show the validity of this test by a comparison with the results of the standardized STEP reading test.

The item analysis program¹ yielded both a difficulty index and a biserial coefficient of correlation for each item. To retain the greatest possible number of discriminations among the scores of individuals, as many items as possible which hovered about a difficulty index of 0.500, more than seventy per cent (or 150) of the items, were selected for use in the Connectives Reading Test. All 150 test items had biserial coefficients of correlation greater than 0.200 and only nine items had correlations lower than 0.300. A careful study was made of each test item retained for the study to ensure that students who were achieving higher scores were not being penalized because they saw more possibilities in the alternate answers than other students.

Alternate format

In discussions that followed the appraisal of the pilot study, the question was raised whether or not the students had found the test as difficult as they did because the particular connective being tested was retained in the main body of the sentence, separated from the alternate answers. Therefore, an alternate format for a random selection of test items was constructed placing the connective being *tested* at the beginning of each alternate answer for each test item. It was hypothesized that there would be no significant difference between the scores of the students on the items, regular format, and

1. This unpublished program is available from the Division of Educational Research Services, Faculty of Education, University of Alberta.

the same items, alternate format. After administration of the two forms of the test to 92 children, a t statistic was computed but with a value of $t=1$ for a two-tailed test at the .001 level, there was no significant difference and the null hypothesis was upheld. No further consideration was given to testing with an alternate format.

Written Connectives Test

The ability of children to join ideas acceptably with connectives of their own choosing was informally assessed by the Written Connectives Test. As encoding of the children's thoughts was necessary in addition to decoding, the bounds set for the Connectives Reading Test were extended.

When the 199 test items used in the pilot study were reduced to 150 for the Connectives Reading Test, 20 of the 49 rejected items were retained for the Written Connectives Test. Each of the twenty items had been shown to be both reliable and valid in the pilot study. The correct answer for each item was written in and the connective of the sentence was deleted. Each item, therefore, consisted of a sentence complete except for the connective. The children were instructed to select one word which they felt would best fill the space where the connective had been deleted. Fourteen of the test items had one space each where the connective had been deleted. Five items contained two spaces in the sentence from the deletion of two connectives and one item had three spaces.

The collection and treatment of data

Because some research (McKie, 1963) has indicated that children from various population strata may have their own strengths and weaknesses in the language arts, a stratified random sample was drawn proportionate to the population strata of the province of Alberta. A test sample of 402 children, aged eight to twelve, grades four to six, was chosen from this population. Fifty-one per cent of the subjects lived in cities, 12 per cent lived in small towns, and 37 per cent lived in rural areas.

Several types of data were collected. The Connectives Reading Test, prepared especially to appraise understanding of connectives in reading, was administered to all subjects. Mental ability was assessed by the Cooperative School and College Ability Test (SCAT) Level 5, Form 5A while the STEP Tests, Level 4, Form 4A, in reading, writing,

Table 6 Statistical procedures used in the treatment of the data

<i>Statistical procedure</i>	<i>Use of procedures</i>
Item analysis	<ul style="list-style-type: none"> — counter check on the reliability and validity of the test. — identification of student membership of each of five achievement groups in sample. — identification of most difficult test items. — analysis of student achievement on test items.
Correlation coefficient computation	<ul style="list-style-type: none"> — assessment of relationships between total test scores on Connectives Reading Test and scores of test items assessing reading comprehension of each of 17 connectives by grade and sex. — assessment of relationships between Connectives Reading Test and selected variables.
Stepwise multiple regression analysis	— ability of seven covariants to predict total score on Connectives Reading Test (Efroymsen, 1960).
One-way analysis of variance	— test of significance of variations in student performance on Connectives Reading Test by grade (Winer, 1962).
Three-factor experiment with repeated measures on one factor	— determination of effect of three factors of sex, grade, and Connectives Reading Test on test scores for each of 17 connective sub-tests and the total test scores of the Connectives Reading Test (Bottenberg & Ward, 1963).
Three-way analysis variance	— test of significance of variations in student performance on Connectives Reading Test by grade, sex, and place of residence (Bottenberg & Ward, 1963).
Analysis of covariance	— determination as to whether the initial differences on five variables identified by step-wise multiple regression analysis were important to final scores on Connectives Reading Test (Bottenberg & Ward, 1963).
Principal-axis factor analysis	— assessment of whether the variance of Connectives Reading Test scores could be accounted for by a number of smaller basic categories than the criterion factor, connective(s) present in each test item (Wilkinson, 1960).

and listening assessed achievement in these three areas. Each subject's father was rated on the Occupational Class Scale (Blishen, *et al.*, 1961).

The analysis of the data, the effects of the variables of sex, chronological age, mental ability, socio-economic status, and achievement in listening, reading, and written language were controlled statistically. The score on the Connectives Reading Test was used as the criterion variable. The statistical procedures, summarized in Table 6, were designed for the study, and programed for use on the IBM

7040 by the Division of Educational Research Services at the Faculty of Education, University of Alberta.¹

The children's answers to all tests except the Written Connectives Test were scored by the IBM Optical Mark Reader, while test papers for the latter were hand scored. Three markers, the investigator and two other experienced elementary school teachers, assessed the work of 394 students who attempted the Written Connectives Test. The Kendall Coefficient of Concordance: W was computed and found to be 0.936, a high value with $p < .001$ (Siegel, 1956). Student scores were grouped by grade, sex, and population strata for comparisons.

In a non-statistical analysis, the percentages of certain language elements and structures in each Connectives Reading Test item by designated difficulty index ranges were computed to isolate

Table 7 Summary of students' answers on Connectives Reading Test by grade

<i>Students: No. and grade</i>	<i>Connective class</i>	<i>No. test items</i>	<i>Grade</i>	<i>Percentage of students who chose:</i>			
				<i>Answers</i>			
				<i>Correct</i>	<i>Gramm. error</i>	<i>Situat. error</i>	<i>Wrong conn.</i>
134 in each of grades 4, 5, 6	Subordinate simple includer clause conn. (although, because, if, so, that, when, where)	63	4	60.32	19.61	7.91	12.16
			5	68.99	15.10	6.51	9.41
			6	77.14	11.30	4.90	6.66
	Subordinate clause conn.—relative pronouns (that, which, who)	28	4	54.86	21.24	7.92	15.98
			5	65.41	15.80	5.97	12.82
			6	75.14	13.28	3.38	8.20
	Subordinate clause connective "Absent"	9	4	62.29	18.46	7.84	11.41
			5	70.71	16.17	4.86	8.26
			6	76.72	12.14	3.39	6.15
	Coordinate clause connective (and, but, for, yet)	36	4	58.16	18.19	8.54	15.11
			5	64.79	14.86	7.60	12.74
			6	73.58	11.91	5.14	9.36
	Sentence linkers (however, thus)	14	4	43.10	19.64	8.69	28.58
			5	53.73	16.10	6.56	23.60
			6	64.59	12.94	5.05	17.42
Totals			4	57.29	19.51	8.13	15.07
			5	65.99	15.33	6.57	12.10
			6	74.72	12.11	4.60	8.56

1. The programs are available upon request.

possible patterns of language difficulties in the test items. The report of this analysis is in Robertson (1966, pp. 263-88).

Findings and conclusions

From Table 7, it is evident that the total student group in grades four to six understood 67 per cent of the sentences having connectives. The understanding level rose from 57 per cent in grade four to 66 per cent in grade five to 75 per cent in grade six. Since basal readers are materials used at an instructional level, it appears that student comprehension in grades four and five is too low. For independent reading materials such as textbooks in science, social studies, and literature where there may be very little reading instruction, this comprehension level is very low, even in grade-six classrooms. Basal readers, such as the three investigated, use connectives freely and, in some instances, the particular type of link most frequently used is a characteristic of the subject matter, e.g., time link in history and cause and effect and comparison in science.

The frequency of types of student errors on the Connectives Reading Test was noted. The greatest percentage of errors was grammatical, with a slightly smaller per cent of wrong connective answers. Situational errors were made the least, approximately one-half of the wrong connective answers. The same order of errors held at each grade level.

From a practical point of view, the students need additional training in looking more carefully at words; failure to note grammatical errors in print eventually reduces their reading comprehension. The low constant rate among the situational errors can be accounted for by the exaggeration of situations in the test item answers to the point at which most children would not be misled.

With the exception of sentence linkers, the students understood the other classes of connectives (relative pronouns, coordinate clause connectives, etc.) equally well. The reading achievement level of students on the sentence linker test items of the Connectives Reading Test was well below the reading achievement level on items of other connective classes.

Without exception, the reading achievement level of fourth-grade students was lower than that of fifth-grade students which, in turn, was lower than sixth-grade children. Reflection of this strong developmental aspect was seen in reverse in the three types of

student errors where percentages of wrong answers made by fourth graders were uniformly higher than those made by fifth graders which, in turn, were higher than those made by sixth graders.

The students' answers were also summarized by each of the 17 connectives showing performance on single and multi-connective items, performance by grade level, and performance by each of the five achievement groups across the three grades and within them. Data for the latter are included in Table 8 and data for the other summaries can be found in Robertson (1966, pp. 150-93).

Table 8 shows that the percentage of students who chose the correct answer in the highest achievement group (Upper 5) rarely dipped below eighty per cent, while those in the lowest group (Upper 1) rarely reached more than fifty per cent. The other three achievement groups showed the same distinct differences in comprehension along any one of the grade levels. Without exception, the percentage of students who chose the correct answers decreased from those in the highest group to those in the next highest group. That is, not only were there more differences in the comprehension of students as their achievement was studied by connective class and then by individual connective from grade to grade, but along any one of these grade levels, at least five distinct levels of comprehension could be identified in the scores of the five achievement groups for any one of the 17 connectives.

From one grade level to another, an interesting pattern of growth between the students in the highest achievement group and those in the lowest achievement group was noted. In the Upper 5 group, the greater growth indicated by the larger percentage difference took place between grade four and grade five; while, for Upper 1, the greater percentage difference was between grade five and grade six.

Six of the 17 individual connectives had comprehension levels below the 66 per cent acquired by the total test group in grades four to six on the Connectives Reading Test. In addition to the two sentence linkers, *however* and *thus*, the other four connectives were *although*, *which*, *and*, and *yet*. Other analyses reported elsewhere (Robertson, 1966) confirmed the difficulty which various groups of students have with these six connectives. Apparently situations involving concession are hard for students to understand. Students may have trouble linking ideas with *and* since there are a wide variety of meanings attributed to this connective. *Which* and *thus*, seldom

Table 8
Student performance in each achievement group on the Connectives Reading Test
(Grade by grade)

Connective	Grade	Percentage of students who chose: correct answer					Percentage of students who chose: grammatical error answer					Percentage of students who chose: situational error answer					Percentage of students who chose: wrong connective answer				
		Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper
		5	4	3	2	1	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
although	4	77.12	54.80	43.27	36.29	25.10	12.85	27.20	28.98	26.58	28.24	1.57	2.40	4.49	8.02	19.22	8.46	15.60	23.27	29.11	27.45
	5	87.59	76.09	62.61	43.17	22.93	8.28	13.41	18.07	24.32	29.32	0.89	1.09	2.94	6.18	18.42	3.45	9.42	16.39	24.32	29.32
	6	90.33	80.00	77.99	59.57	39.02	7.00	10.36	9.65	21.74	23.48	0.33	-	-	3.48	7.58	2.33	9.84	12.36	15.22	29.92
because	4	78.62	70.16	64.92	49.18	34.94	10.38	17.34	22.98	24.59	23.69	3.77	6.05	5.24	8.61	16.06	7.23	6.45	6.85	17.62	25.30
	5	91.03	79.42	70.17	58.37	37.36	2.76	10.47	13.87	21.79	24.91	2.76	3.25	7.98	7.78	15.09	3.45	6.86	7.98	12.06	22.64
	6	92.00	82.86	80.31	73.04	52.04	3.33	8.93	8.49	14.78	18.96	2.33	1.79	7.34	2.61	13.38	2.33	6.43	7.34	9.57	15.61
if	4	86.81	71.36	68.18	57.01	28.88	10.07	20.45	20.45	21.27	26.29	2.78	4.09	6.82	10.41	20.69	0.35	4.09	4.55	11.31	24.14
	5	93.49	80.80	77.00	70.26	39.33	3.45	12.40	15.96	18.10	27.20	2.68	4.80	5.63	6.90	16.32	0.38	2.00	1.41	4.74	17.15
	6	93.31	86.90	79.83	74.76	54.81	4.09	7.54	12.45	17.48	24.27	0.74	2.78	6.01	4.37	11.72	1.86	2.78	1.72	3.40	9.21
so	4	94.39	82.88	71.43	56.07	35.53	4.56	9.91	17.51	22.43	23.68	0.35	2.70	3.23	7.01	16.23	0.70	4.50	7.83	14.49	24.56
	5	97.32	90.76	87.14	72.84	40.08	1.15	7.63	10.00	18.10	28.27	-	0.40	1.43	3.02	13.08	1.53	1.20	1.43	6.03	18.57
	6	96.30	94.02	88.26	83.01	62.55	2.96	3.59	8.26	12.62	20.43	0.37	1.59	1.30	1.94	10.21	0.37	0.80	2.17	2.43	6.81
that (simple includer)	4	86.62	68.00	63.87	53.10	30.95	10.83	21.60	21.01	26.55	27.78	-	2.40	6.72	6.19	16.67	2.55	8.00	8.40	14.16	24.60
	5	93.10	86.96	73.91	62.50	39.69	4.83	7.25	16.52	22.66	24.43	-	0.72	4.35	5.47	16.79	2.07	5.07	5.22	9.38	19.08
	6	93.33	87.05	86.05	75.65	52.99	2.00	7.19	5.43	13.91	22.39	0.67	1.44	2.33	4.35	9.70	4.00	4.32	6.20	6.09	14.93
when	4	85.26	71.56	69.44	41.40	31.08	6.67	10.55	14.35	23.72	26.13	2.81	11.93	8.80	16.28	25.23	5.26	5.96	7.41	18.60	17.57
	5	91.57	81.53	71.43	53.88	31.06	2.30	6.83	10.95	18.97	24.26	3.45	5.62	9.05	12.07	21.70	2.68	6.02	8.57	15.09	22.98
	6	92.57	84.13	81.97	69.46	52.48	1.12	4.76	7.30	8.87	18.18	4.09	5.16	6.01	12.32	14.05	2.23	5.95	4.72	9.36	15.29
where	4	87.97	80.00	66.30	54.55	37.10	8.02	16.36	21.61	23.86	28.62	2.29	2.18	4.40	4.92	15.90	1.72	1.45	7.69	16.67	18.37
	5	90.91	84.21	77.57	68.77	36.61	6.90	11.84	18.63	16.84	23.39	1.25	1.32	0.76	7.02	16.61	0.94	2.63	3.04	7.37	23.38
	6	94.24	90.55	84.62	78.57	56.66	3.94	7.82	10.14	16.27	21.50	1.21	1.30	2.45	1.98	11.26	0.61	0.33	2.80	3.17	10.58
that (relative pronoun)	4	86.98	69.59	55.10	39.66	30.49	4.43	11.49	19.73	25.17	25.57	2.34	4.39	8.84	9.66	20.00	6.25	14.53	16.33	25.52	23.93
	5	91.95	85.84	66.78	55.48	35.42	2.59	5.42	10.14	19.35	30.41	2.01	0.90	4.20	7.42	15.99	3.45	7.83	18.88	17.74	18.18
	6	96.10	85.89	82.69	65.69	51.37	2.51	4.91	7.69	16.42	19.45	0.56	1.53	2.24	3.65	12.16	0.84	7.67	7.37	14.23	17.02

Table 8 (continued)

Connective	Grade	Percentage of students who chose: correct answer					Percentage of students who chose: grammatical error answer					Percentage of students who chose: situational error answer					Percentage of students who chose: wrong connective answer				
		Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper
		5	4	3	2	1	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
which	4	74.41	68.84	43.08	39.38	28.30	14.57	16.58	24.62	30.57	29.50	3.15	4.52	8.72	7.77	16.00	7.87	10.05	23.59	22.28	26.00
	5	86.21	78.73	64.92	45.89	29.11	9.05	9.50	19.90	26.57	24.88	1.29	3.17	3.14	6.28	20.19	3.45	8.60	12.04	21.26	25.82
	6	91.63	82.14	77.78	77.05	44.39	6.69	8.93	13.04	14.21	24.77	0.84	2.68	1.45	2.19	7.94	0.84	6.25	7.73	6.56	22.90
who	4	83.14	63.78	59.28	42.27	34.48	10.20	23.98	25.26	33.51	33.50	2.35	1.53	5.15	7.73	13.79	4.31	10.71	10.31	16.49	18.23
	5	90.52	86.61	73.16	49.76	36.82	5.60	8.48	16.84	26.57	27.23	1.72	0.89	2.11	5.31	14.55	2.16	4.02	7.89	18.36	21.60
	6	89.87	85.27	82.21	59.89	52.09	5.49	12.50	12.98	28.57	28.84	1.27	1.79	0.96	2.20	7.44	3.38	0.45	3.85	9.34	11.63
"absent"	4	84.27	74.11	66.97	51.87	34.23	12.24	16.52	16.74	23.36	23.42	2.45	3.57	4.07	7.94	21.17	1.05	5.80	12.22	16.82	21.17
	5	90.04	83.47	73.68	63.76	41.84	6.90	13.31	17.22	17.47	25.94	1.53	0.81	2.87	6.55	12.55	0.77	2.42	6.22	12.23	19.57
	6	90.37	87.65	79.74	69.42	56.43	7.78	8.76	13.36	18.45	20.33	1.99	1.99	2.59	2.43	9.96	1.85	1.59	4.31	9.71	13.28
and	4	78.47	63.11	55.11	41.33	27.16	10.76	16.89	19.56	27.56	26.34	4.51	4.44	3.11	8.00	17.28	6.25	15.56	20.44	19.11	23.87
	5	90.04	77.38	59.72	48.72	25.10	4.22	11.51	16.67	23.93	31.28	2.68	3.17	6.48	9.40	17.70	2.68	6.75	15.74	17.09	25.51
	6	92.22	80.16	70.51	65.70	38.27	4.44	9.13	17.09	16.91	26.75	1.11	5.16	4.27	3.87	10.70	2.22	5.56	7.69	13.53	23.05
but	4	86.12	72.18	61.79	52.10	33.33	8.52	14.11	21.14	23.11	27.24	3.15	5.24	4.47	6.30	17.48	2.21	8.47	12.60	18.49	21.95
	5	86.90	80.43	70.76	55.51	30.80	5.86	10.87	16.53	25.98	23.57	5.17	2.54	2.54	5.51	20.15	2.07	6.16	10.17	12.99	25.48
	6	90.67	81.43	77.61	69.43	49.43	5.67	11.43	8.88	15.28	20.15	2.00	3.93	6.18	4.37	12.17	1.67	3.21	7.34	10.92	18.25
for	4	87.11	71.43	63.18	53.46	36.64	6.97	15.18	18.64	22.12	21.98	2.09	4.02	6.36	6.45	18.10	3.83	9.38	11.82	17.97	23.28
	5	91.19	84.74	71.96	60.52	40.34	4.60	8.03	12.62	19.31	19.75	0.77	1.61	2.80	5.15	20.17	3.45	5.62	12.62	15.02	19.75
	6	92.59	88.84	79.40	70.87	59.09	3.70	4.38	9.87	17.96	19.01	1.59	1.59	3.43	2.91	7.44	3.70	5.18	7.30	8.25	14.46
yet	4	81.42	68.18	55.00	41.67	26.60	5.53	10.10	16.50	20.31	26.60	5.93	9.09	8.00	13.02	25.12	7.11	12.63	20.50	25.00	21.67
	5	88.79	78.38	70.53	51.46	29.44	4.31	7.21	8.42	14.98	23.23	2.16	5.86	6.32	13.59	19.16	4.74	8.56	14.74	20.87	26.17
	6	87.08	82.06	78.37	71.04	45.54	3.03	4.98	7.69	6.56	21.60	3.33	4.93	5.77	7.10	13.15	4.58	8.52	8.17	15.30	19.72
however	4	72.05	64.00	44.90	38.14	35.82	6.69	13.00	18.88	15.98	18.41	3.54	6.00	5.61	11.34	18.41	17.72	17.00	30.61	34.54	27.36
	5	87.01	79.19	56.91	49.75	29.77	3.03	4.98	11.70	12.81	14.88	3.46	4.79	4.26	6.90	14.88	6.49	10.86	27.13	30.54	31.16
	6	88.33	79.46	74.51	64.48	49.77	4.58	4.91	7.35	12.02	14.88	2.08	1.79	2.94	4.92	14.88	5.00	13.84	15.20	18.58	18.14
thus	4	47.40	30.87	30.34	30.77	23.33	18.23	29.53	31.72	26.57	26.00	1.56	0.67	6.21	7.69	25.33	32.81	38.93	31.72	34.97	25.33
	5	66.47	52.41	48.48	29.22	30.38	11.56	22.29	26.76	31.17	20.25	0.58	-	2.11	6.49	21.52	21.39	25.30	26.06	33.12	27.85
	6	83.24	68.26	47.44	45.99	33.33	5.59	16.17	21.79	22.63	23.27	0.56	0.60	3.85	5.84	12.58	10.61	14.97	26.92	25.55	30.82

used by students, are typical of problems they have with the more formal language structures of print. Difficulty with *yet* indicated that children cannot hold information units in reading well while they consider other information given to them.

Additional statistical procedures then followed the item analyses to ascertain the relationship existing between the Connectives Reading Test, the 17 connective groups in it, and other variables as well as the significance of these relationships.

The connective analyses indicated that the 17 connective groups had a high positive relationship to the Connectives Reading Test as a whole. To determine whether this relationship actually existed, correlations were computed between the students' total test scores and their scores on each of the 17 sub-tests. Each sub-test was made up of the items testing a particular connective. The correlations with the STEP Reading Test were also given for comparison (Table 9).

From the high positive correlations, it could be expected that from a student's score on any one of the connective groupings with

Table 9 Correlations between total scores on Connectives Reading Test and the 17 connective group scores (N=402)

Correlation of student scores on items testing the connective:	with:	Connectives Reading Test		STEP Reading Test	
		Total scores correlation	Rank order	Total scores correlation	Rank order
"although"		0.852	3	0.728	4
"because"		0.822	7	0.685	7
"if"		0.817	9	0.718	5
"so"		0.835	4	0.753	2
"that"—simple includer		0.744	16	0.608	16
"when"		0.827	5	0.689	6
"where"		0.863	2	0.757	1
"that"—relative pronoun		0.884	1	0.743	3
"which"		0.812	11	0.656	10
"who"		0.808	13	0.646	14
"and"		0.804	14	0.647	13
"but"		0.822	7	0.684	8
"for"		0.813	10	0.653	12
"yet"		0.827	5	0.673	9
"absent"		0.812	11	0.656	10
"however"		0.760	15	0.637	15
"thus"		0.597	17	0.499	17
All connectives		1.00		0.834	

the possible exception of the *thus* group, the student's score on the entire test could be predicted with a moderate degree of accuracy. High positive relationships were revealed also between each of the 17 connective groupings with the STEP test and between this test and the Connectives Reading Test.

From correlations calculated between certain variables and the Connective Reading Test, it was noted that all but chronological age and socio-economic status had a functional relationship to the test. A step-wise multiple regression analysis was carried out to find out which of the variables would constitute the best set to predict the greatest variance of the Connectives Reading Test. Data in Table 10 confirm that the effects of both the variables of chronological age and socio-economic status were not significant.

Table 10 Calculations in step-wise regression analysis

Step no.	Source of variance added	F ratio	t test value	Per cent variance predicted (K')	Total variance predicted
Step #1	STEP Writing Test	1110.58	**	73.52	73.52
Step #2	SCAT—verbal section of test	861.66	162.99**	7.68	81.20
Step #3	STEP Reading Test	637.91	36.61**	1.58	82.78
Step #4	SCAT—non-verbal section of test	486.06	6.08**	0.26	83.04
Step #5	STEP Listening Test	391.05	2.70**	0.11	83.16
Step #6	Chronological age	325.50	0.45*	0.02	83.18
Step #7	Socio-economic status	278.35	0.07*	0.00	83.18

*Not significant at the 0.05 level for a two-tailed test.

**Significant at 0.01 level for a two-tailed test.

Hypothesis I, then, was untenable for each of the variables except chronological age and socio-economic status. There is a significant relationship between a child's understanding of connectives in reading and the factors of sex, mental age (both verbal and non-verbal), and of ability in listening, reading, and written language.

A one-way analysis of variance was carried out to find out if the grade levels had any real effect on the variance of the Connectives Reading Test scores. For each of the 17 sub-tests as well as for the total test scores, an analysis was completed to find out if the variance among the means of the five achievement groups around the grand mean of the groups differed significantly from the variance within each of the five achievement groups. Computations were made for grade four, five, and six, individually as well as for the total test group. These computations are presented in Table 11.

Table 11 Summary of analysis of variance—grades four to six

Scores grouping test items	Source of variance and sums of squares		Mean squares		df		F*
	Among means ach. groups	Within ach. groups	Among means ach. groups	Within ach. groups	Among means ach. groups	Within ach. groups	
"although"	2032.4392	693.5135	508.11	1.75	4	397	290.87
"because"	1332.9409	844.1538	333.24	2.13	4	397	156.72
"if"	1077.6959	659.8489	269.42	1.66	4	397	172.10
"so"	1309.5032	651.6611	327.38	1.64	4	397	199.44
"that" (simple inc.)	389.3434	318.8556	97.34	0.80	4	397	121.19
"when"	1384.3777	727.6124	346.09	1.83	4	397	188.84
"where"	1720.8330	678.9185	430.21	1.71	4	397	251.57
"that" (rel. pro.)	2631.6404	915.2378	657.91	2.31	4	397	285.38
"which"	1172.9739	559.6058	293.24	1.41	4	397	208.04
"who"	1024.6014	582.1672	256.15	1.47	4	397	174.68
"and"	1348.4509	817.1511	337.11	2.06	4	397	163.78
"but"	1452.7102	782.9739	363.18	1.97	4	397	184.15
"for"	1047.6661	550.4658	261.92	1.39	4	397	188.90
"yet"	1058.6528	559.3672	264.66	1.41	4	397	187.84
"absent"	1034.6969	591.9226	258.67	1.49	4	397	173.49
"however"	924.3098	712.9639	231.08	1.80	4	397	128.67
"thus"	387.8586	546.1315	96.96	1.38	4	397	70.49
Total scores (All test items)	329,046.15	27,099.937	82,261.54	68.26	4	397	1,205.09

* $p < .001$

The variance ratios for each of the 17 connective groupings and for the total scores groups were highly significant with a probability of $p < .001$. It appeared that for each student test group, a factor was affecting the test scores significantly. As a connective was common to each test item, it also followed that this linguistic element could be a portion of that factor. There is a significant increase from grade to grade in the students' understanding of connectives. Thus, Hypothesis II could not be upheld.

As reported previously, the percentage of correct answers increased with a corresponding decrease in the percentage of wrong connective, grammatical, and situational error answers. Since there were significant differences between the students' achievement scores (that is, their selection of the correct answers) at each of the three grade levels, Hypothesis V is untenable. There is a significant difference between the child's understanding of connectives and the types of errors he makes as he reads.

The item analyses showed that among the 17 connectives there were different percentages of correct answers. Also, the sums of squares for each connective, grade by grade, varied one from the

other proving that there was a real difference between the test scores of the connective groupings and the total test scores at each grade level. There was, then, a lack of uniformity in the rate of development of understanding among the different connectives. Therefore, Hypothesis III could not be upheld.

Because of the significant variance ratios, a Newman-Keuls comparison was employed to find out which of the five means in a particular group was different from the other. A summary of the results of this comparison is given in Table 12.

TABLE 12
NEWMAN-KEULS comparison between ordered means

Grouping of Scores by Connectives	ACHIEVEMENT GROUPS																			
	Grades 4 – 6					Grade 4					Grade 5					Grade 6				
	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
“although”									x		x					ns	ns			
“because”						ns		ns			ns		x			ns	ns	ns		
“if”							ns				x		ns	ns		ns	ns	ns		
“so”	ns					ns		ns			x		ns			ns	ns	ns		
“that” (simple includer)	ns					ns		ns	x		ns		ns			ns	ns	ns		
“when”						x		ns			ns		x			ns	ns	ns		
“where		x				ns					ns		ns			ns	ns	ns		
“that” (relative pronoun)											ns					x		ns		
“which”		ns				ns		x			ns		ns			ns	ns	ns		

“ ns ” the two means connected by a line are not significantly different at the 0.05 level of significance.

“ x ” the two means connected by a line are different at the 0.05 level of significance.

All of the groups with no markings were different from each other at the 0.01 level of significance.

TABLE 12 (continued)

Grouping of Scores by Connectives	ACHIEVEMENT GROUPS																			
	Grades 4 – 6					Grade 4					Grade 5					Grade 6				
	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
“who”	ns						x			.x						ns	ns	x		
“and”						x	x		ns		x		x			ns	x		ns	
“but”											ns		ns			ns	ns		ns	
“for”	ns					x		ns			x		ns			ns	ns			x
“yet”	ns						x				ns		ns			ns	ns		ns	
“absent”	ns					ns		ns			ns			ns		ns	ns			
“however”						ns		ns	ns		ns			ns		ns	ns		ns	
“thus”			x	x		ns	ns	ns	ns		x		ns	ns	ns	ns			ns	x
Total																	x			

In the total group tested (grades four to six achievement groups), there were only seven pairs of means out of a possible 180 pairs which were not significantly different one from the other. The differences reported in the preceding section as percentages of correct answers from one achievement group to another were almost all real differences then, and Hypothesis IV could not be upheld. There is a significant variation in the students' understanding of a connective at one grade level. For the total student group across the three grades, almost all five achievement groups were significantly different one from the other. Singly, at each of the grade four, five, and six levels, there were fewer significant differences although they still far out-numbered the non-significant differences.

A minimum description of statistical procedures in the treatment of data has been offered to justify conclusions made regarding

the null hypotheses, but similar descriptions for other analyses (see Table 6) are impossible. Therefore, a brief summary of main findings must suffice. All supporting details are available in Robertson's (1966, pp. 150-288) dissertation.

From the three factor analysis, it was learned that both grade and sex affected total test scores on the Connectives Reading Test significantly from their total test scores. Various sets of interactions showed that for some connective groups the combined working of two factors was a positive influence in the learning environment. Further investigation showed that in grades four and five the boys appeared to lag in their reading comprehension of connectives behind the girls, particularly in the use of coordinate connectives and connectives associated with the expression of condition.

In the three-way analysis of variance, in addition to confirming that both grade and sex were factors which exerted marked effects on total test scores in the Connectives Reading Test, it was noted that the population strata factor, that is, place of residence, was significant also.

Through the two-way analysis of variance by grade, the effects of both sex and population strata could be better assessed at each grade level. The needs of boys in grades four and five and of rural students in grade five were revealed.

The five covariants were student achievement in listening, reading, and writing, and in mental ability, both verbal and non-verbal. When these additional statistical controls were applied in the two-way analysis, the sex factor was barely significant at the grade-five level only, but the population strata factor showed strong effects in both grades four and six.

In the three-way analysis of covariance by grade, sex, and population strata, only the latter showed a significant effect on total test scores of the Connectives Reading Test. Place of residence exerted a very marked effect on the scores of the reading test.

The conduct of the principal-axis factor analysis showed that the Connectives Reading Test was a unifactor one with the 17 connective groups of scores accounting for 63 per cent of the total test variance.

Certainly the performance of students on the connectives test was affected by their sex, grade, and place of residence.

Through the statistical control of the covariants, it could be seen that there was a factor common to the STEP and SCAT tests

used in the study, which was also common to the Connectives Reading Test.

Written Connectives Test

The children gave a wide variety of answers to the twenty items of the Written Connectives Test, all of which were marked and entered as percentages of acceptable answers.

As this test required the students to encode as well as decode, thereby requiring language abilities beyond that of reading, the results have been used only for gross comparisons with the Connectives Reading Test. Because comparisons have been made on the percentages of acceptable answers to which no statistical techniques have been applied, statements made are only observations which future investigations have to confirm.

When the Connectives Reading Test was compared with the Written Connectives Test, the over-all percentages of acceptable answers were very close, but from grade to grade a trend appeared to develop in which children did better on the Connectives Reading Test than on the Written Connectives Test. The three factors of sex, grade, and population strata (by place of residence) again appeared to be significant factors on this test. The girls consistently obtained higher marks than the boys on the Written Connectives Test and students in a lower grade lagged behind those in a higher grade in achievement. Children in urban areas achieved higher scores than those in small towns, who in turn, did better than those in rural areas. However, upon further investigation, the strength of the test performance of girls in rural areas and of boys in small towns was pronounced.

Among the individual connective items, test blanks which could have been acceptably filled with *although*, *and*, and *yet* proved as hard for students as they were on the Connectives Reading Test. Sentence structures communicating concession are apparently difficult for children at these grade levels. The students did not choose to use connectives such as *thus* but substituted suitable connectives more common in their speech.

Implications of the study

Since the reading comprehension level of students in grades four and five, as revealed in this study, may be termed inadequate, it

appears that the developmental reading program should intensify the systematic teaching of comprehension skills. Special provision could then be made for the development of understanding of either connectives which are characteristic of the formal language of print, or connectives which have not yet become a part of the speech of students or which are not yet understood by them in the speech of others.

As students develop in understanding of connectives from grade to grade at different rates for individual connectives, there is no plateau of comprehension; educators should both expect and aid this development in reading.

Different rates of development of understanding among students for individual connectives necessitate flexibility in the conduct of the reading program. Also, as boys in grades four and five appear to develop understanding for connectives more slowly than girls, additional adjustments in the reading program may be necessary.

Students who score low on tests of mental ability may need more help with the development of formal language structures which they need as vehicles for logical thought processes. Similarly, students who score high on tests of mental ability should be systematically trained in an earlier grade in the formulation, manipulation, and use of these formal language structures. Development of understanding similar to that in reading can be expected in listening, speaking, and writing, with systematic training in one a possible aid to their understanding of connectives in another.

This study showed that although children acquire language structures using connectives early in life, they gain mature understanding of them gradually throughout their school years. Children use clauses in speech before they go to school but they do not develop a sufficient understanding of the meanings of connectives in print for a number of years after that. Therefore, children should be given systematic training through the reading program so they may develop more facility at an earlier age in understanding increasingly complex communications from the printed page.

REFERENCES

- BLISHEN, B., *et al.* *Canadian society: sociological perspectives*. Toronto: Macmillan Company of Canada, 1961-64.
- BOTTENBERG, R. A., & WARD, J. H., JR. *Applied multiple linear regression*. (Technical Documentary Report PRL-TDR-6306.) United States Department of Commerce, March, 1963.
- DAVIS, EDITH A. *The development of linguistic skills in twins, singletons with siblings, and only children from age five to ten years*. Minneapolis: University of Minnesota Press, 1937.
- DICKIE, D., *et al.* *Canadian parade readers*. Toronto: J. M. Dent, 1954.
- EARLE, J. *The philology of the English tongue*. Oxford: Clarendon, 1871.
- EFROYMSON, M. A. Multiple regression analysis. In A. Ralston & H. S. Wilf (Eds.), *Mathematical methods for digital computers*. New York: Wiley, 1960. Pp. 191-203.
- FLESCHE, R. *The art of plain talk*. New York: Harper, 1946.
- GATES, A. I. *The improvement of reading*. New York: Macmillan, 1947.
- GLEASON, H. A., JR. *Linguistics and English grammar*. Toronto: Holt, Rinehart & Winston, 1965.
- GRAY, W. S., *et al.* *The new basic readers*. Toronto: W. J. Gage, n.d.
- HARRELL, L. E., JR. A comparison of the development of oral and written language in school-age children. *Monograph of the Society for Research in Child Development*, 1957, 22 (3), 63-71.
- HUEY, E. G. *The psychology and pedagogy of reading*. New York: Macmillan, 1912.
- LABRANT, LOU L. A study of certain language developments of children in grades IV to XII, inclusive. *Genetic Psychology Monographs*, 1933, 14, 387-491.
- MCKIE, FLORENCE I. An analysis of the characteristics of free-writing by grade four, five and six students. Unpublished masters thesis, University of Alberta, 1963.
- OSGOOD, C. E. A behaviouristic analysis of perception and language as cognitive phenomena. In Psychology Department (Ed.), *Contemporary approaches to cognition*. Cambridge: Harvard University Press, 1957. Pp. 75-118.
- PIAGET, J. *The language and thought of the child*. New York: World Publishing Company, 1926.
- PIAGET, J. *Judgment and reasoning in the child*. London: Routledge and Kegan Paul, 1928.
- ROBERTSON, JEAN ELIZABETH. An investigation of pupil understanding of connectives in reading. Unpublished doctoral dissertation, University of Alberta, 1966.
- RUDELL, R. B. An investigation of the effect of the similarity of oral and written patterns of language structure on reading comprehension. Unpublished doctoral dissertation, Indiana University, 1963.
- SIEGEL, S. *Nonparametric statistics for the behavioral sciences*. Toronto: McGraw-Hill, 1956.
- SLEDD, J. *A short introduction to English grammar*. Chicago: Scott, Foresman, 1959.
- SMITH, DORA V. Growth and sequence of language. In H. A. Robinson (Ed.), *Reading and the language arts*. Supplementary Educational Monographs, 1963, No. 93.
- SQUIRE, J. R. "Multilevel" research in English: imperatives for the sixties. In E. R. Steinberg (Ed.), *Needed research in the teaching of English*. Washington, D. C.: U. S. Department of Health, Education, and Welfare, 1963. Pp. 26-44.
- STAUFFER, R. G., BURROWS, ALVINA T., & JONES, DILYS M. *Winston basic readers*. New York: Holt, Rinehart, & Winston, 1961.
- THORNDIKE, E. L. Reading as reasoning: a study of mistakes in paragraph reading. *Journal of Educational Psychology*, 1917, 8 (6), 323-32.
- THORNDIKE, E. L., & LORGE, I. *The teacher's word book of 30,000 words*. (3rd ed.) New York: Bureau of Publications, Teachers College, Columbia University, 1959.
- VORLAT, EMMA. *Progress in English grammar 1585-1735*. Vols. 1 & 3. Luxemburg: Catholic University of Louvain, 1963.
- VYGOTSKY, L. S. *Thought and language*. Boston: M.I.T. Press, 1934.
- WATTS, A. F. *The language and mental development of children: an essay in educational psychology*. London: George G. Harrap, 1944.
- WILKINSON, J. H. Householder's method for the solution of the algebraic eigen problem. *Computer Journal*, 1960, 3, 23-27.
- WINER, B. J. *Statistical principles in experimental design*. Toronto: McGraw-Hill, 1962.