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Characteristics of children's note taking and its effect on the recall of prose.

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CHARACTERISTICS OF CHILDREN'S NOTE TAKING AND ITS EFFECT ON THE RECALL OF PROSE

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ABSTRACT

The present study was conducted to determine, developmentally, (a) the characteristics of the notes prepared by children at three grade levels while reading and studying a prose passage, (b) the relationships of these characteristics to recall of information contained in the passage, and (c) the differential effects on recall of preparing notes while reading and studying versus reading and studying without preparing notes.

Forty children at each of three grade levels (3, 5, and 7) were asked to read and study a factual prose passage. Half the children at each grade level were asked to prepare notes while reading and studying, while the other half could not prepare notes. Recall was tested immediately after the study period, and again after about three weeks.

The major findings of the study were that the notes taken by older children tended to contain more relevant facts and more irrelevant facts than did the notes taken by younger children. The ratio of relevant facts to the total words contained in the notes also increased with age. Also, the percentage of irrelevant facts, in relation to total facts recorded, decreased with age as did the number of children either copying verbatim or ignoring the information contained in the passage. These changes in

"note taking style" were hypothesized to have resulted from (1) an increase, with age, in the ability to utilize the skills required by the task and (2) an increase, with age, in the ability to correctly match the task at hand with the proper skills required to solve the task.

Other findings indicated that the note characteristics examined were poor predictors of the children's recall, with one possible exception being the relationship between the number of relevant facts recorded in the notes and the number recalled. In addition, seventh graders who studied by reading the passage without taking notes recalled more relevant facts than did seventh graders who took notes, while at grade 5 it was the note takers who recalled more. At grade 3, recall did not differ between conditions. These results were found on both the immediate and the delayed tests. It was hypothesized that the effect of note taking on recall may have resulted from (1) differences between grade levels in understanding the instructions given, (2) unequal task difficulty at the grade levels used, or (3) factors created by the dynamics of the individual groups tested.

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CHAPTER I

INTRODUCTION

Practical guides to methods of studying (e.g. Morgan and Deese, 1957; Pauk, 1962) often recommend note taking as a technique for facilitating the learning of prose material. However, the scientific examination of note taking has not been extensive. The study reported here attempts to expand the scientific investigation of note taking. It focuses on the notes prepared by children while they read and studied a prose passage. Both the characteristics of notes taken and the facilitative effect of such notes on the recall of information contained in the passage were investigated.

Note Characteristics

Despite the widespread practice in educational settings of preparing notes for future study (e.g. while listening to a lecture or reading a textbook), few studies have reported on the characteristics of the notes taken. Recently, several pleas have appeared calling for an examination of note characteristics as a means of examining the processes involved in learning from prose. For example, DiVesta and Gray (1972) feel that more needs to be known about the relationship between the specific points made in the notes and what is recalled and what is not recalled. Also, Howe (1970) has stated that, in examining the

relationship between learning and individual coding mechanisms, it may prove interesting to explore individual differences in note taking. If one assumes (as DiVesta and Gray and Howe appear to) that the notes taken are related in some way to the processes underlying learning from prose, then such information regarding the characteristics of notes may prove beneficial to the study of the learning process. As the development of the learning process is itself an important topic, it might prove especially beneficial not only to study the characteristics of adult learners, but also the characteristics of notes taken by children, and to determine if there are any developmental trends in these characteristics. Of course, before this can be determined what is first needed is a description of the characteristics of notes taken by children. Such data are presently lacking. Therefore, the primary purpose of the present study was to determine the characteristics of notes taken by children of different ages when required to take notes when reading and studying a prose passage.

Several possibilities for note characteristics which may prove beneficial to study developmentally have been suggested by examinations of adult note taking. These are: note relevancy; note efficiency; and note irrelevancy.

Note relevancy is defined here in a manner similar to that used by Fisher and Harris (1973). It refers to the

number of relevant facts, with respect to the demands of the learning situation, contained in the notes. Some evidence exists that the relevancy of the notes taken while attending to material is related to the amount of information about that material that is recalled. Crawford (1925) and Fisher and Harris (1973) have reported a positive correlation between the number of points recorded in the notes of a spoken lecture and the number recalled on a free recall test. Howe (1970) found that the probability of recalling any given item recorded in the notes of a lecture three weeks after the lecture was seven times greater than that of recalling any given item not recorded in the notes. It is possible that note relevancy shows a developmental trend in that as children grow older they might be expected to attend more to relevant information (Collins, 1970) and that this increase in attention would be reflected in their notes.

A second characteristic that has been investigated with adult learners is the efficiency of the notes, defined by Howe(1970) as the ratio of the note relevancy to the total number of words contained in the notes. Howe (1970) has found that this measure correlates positively with subsequent recall. Fisher and Harris (1973) did not confirm this finding, but the possibility remains that note efficiency is related to recall. Since this possibility exists,

it was decided to investigate this characteristic developmentally.

In a study not involving notes but rather successive attempts to recall a spoken passage, Kay (1955) found that a subject's successive reproductions were highly similar to each other, including the repetition of errors on successive attempts. This was true even though the correct version of the passage was read after each recall attempt. Howe (1969, reported in Howe 1970) has reported findings substantially supporting Kay's. This suggests the possibility that errors or other "irrelevant" information that is recorded in the notes might become "fixed" in memory and interfere, in some way, with the recall of relevant information. This in turn suggests a third characteristic worthy of investigating, that of note irrelevancy. Note irrelevancy may be defined as the number of irrelevant facts contained in the notes (e.g. errors, information not relevant to task demands). Since as children grow older they gradually begin to process task relevant information to the exclusion of task irrelevant information (Collins, 1970; Hagen, 1967; Siegal and Stevenson, 1966), it might be suspected that note irrelevancy is inversely correlated with age.

Thus, these three characteristics (relevancy, efficiency, and irrelevancy) were chosen because of the

possibility that they might show developmental changes and because there is at least suggestive evidence that they may be related to the information recalled.

Note Characteristics and Recall

A second purpose of the present study, and related to the identification of the characteristics of children's notes, is to determine the relationship between these characteristics and the amount of information recalled, both relevant to, and not relevant to, the task demands. This is done in part to determine if there are any grounds for assuming that such note characteristics are related to, or reflect in some way, the processes underlying learning from prose material. It is done in part, also, in the event that preparing notes for future study enhances learning and recall. In this event, it may prove helpful to determine which aspects or characteristics of note taking are most responsible for the enhancement.

Note Taking versus Reading

An important educational question is whether preparing notes for future study while reading produces superior recall as compared with reading and studying. Apparently, this contention is believed to be true in educational circles as evident from the wide use of note taking in our educational system and its recommendation by books on how to study (Morgan and Deese, 1957; Pauk, 1962). A large part

of its popularity is no doubt due to the opportunity note taking provides for review of the study material after the original material is no longer accessible. In addition to its "review" function, note taking is also believed to function as an "encoding mechanism" (DiVesta and Gray, 1972). As an "encoding mechanism", notes allow the learner to transcribe (and practice by writing) whatever subjective associations, inferences, and interpretations occur to him while reading. This active interaction with the material facilitates the linking of the study material to the learner's existing cognitive structure, thereby rendering it meaningful and facilitating its recall (DiVesta and Gray, 1972). It is this second function of note taking that DiVesta and Gray (1972) and Howe (1970) believe to be most important. According to this view, note taking will facilitate recall of the material studied even in the absence of an opportunity to review the notes taken. In addition, Crawford (1925b), in an early study of note taking, concluded that while the review value of notes is most important, the practice of taking notes per se is of sufficient value in improving recall to justify the practice even if there is no opportunity to use them later. Thus, at least according to these investigators, note taking appears to facilitate recall both as an "external storage device" and as an "encoding mechanism". In the present study, no

effort was made to manipulate the extent to which notes served as an "encoding mechanism" or as an "external storage device". This was so because of primary concern in the present study was a determination of the characteristics of children's notes and conditions were manipulated so as to insure that all subjects took notes if requested to do so. However, because the issue has important educational implications, it was decided, as a third purpose of the present study, to determine if note taking as presently construed (i.e. subjects were instructed to read and study a passage and also to write down things that were important to remember, as the passage would later be taken away leaving only the notes to study from, but no such review period was actually provided) facilitates children's recall of prose as compared to reading and studying the passage without taking notes. This question was investigated with respect to the recall of material relevant to the task demands, as well as with respect to the correct recall of material contained in the passage but not relevant to the task demands (non-relevant information, to be contrasted with the term "irrelevancy", which includes errors and refers only to the notes themselves and not to what is recalled).

The Present Study

The present study is an attempt to investigate the

characteristics of children's note taking and the effect of such note taking on the recall of information contained in a prose passage. In order to maximize possible educational implications, an effort was made throughout the experiment to keep both the material studied and the learning situation itself as school-like as possible. However, investigations of study activities which have utilized discrete items (e.g. pictures of objects) were considered in the design of the study in that such studies have demonstrated that the types of activities engaged in and their effect on recall differ with age (see Flavell, 1970). Therefore, it was suspected that the characteristics of the notes themselves, their relationship to recall, and the effect of note taking per se on recall might change with the age of the children investigated. In view of this, children of grades 3, 5, and 7 were asked to remember specific factual information from a prose passage that also contained "task irrelevant" information. Grade 3 children were used because these children have just acquired the capability to take notes while studying. Grade 7 children were used because at this age note taking is often practiced in the schools, as well as because previous studies have suggested that by this age children have begun to process task relevant information while ignoring task irrelevant information (Collins, 1970;

Hagen, 1967; Siegal and Stevenson, 1966). To more fully describe any developmental changes, grade 5 children were also used. At each of the three grade levels, children were divided into two conditions: (a) children in the first condition were asked to remember specific factual information contained in a prose passage by reading and studying the passage (reading condition); (b) children in the second condition, in addition to reading and studying the passage, were also asked to make notes on what they thought was important to remember about the passage (notes condition). For both conditions, recall was tested immediately after studying the material and after a three week delay. The delay test was included to determine the stability or longevity of the results. When examining the relationship between recall and a suspected study aide, such as note taking, it is important, from an educational standpoint, to determine whether the relationship is stable or merely momentary.

CHAPTER II

METHOD

Design and Subjects

One hundred and thirty one subjects from grades 3, 5, and 7 were involved in the experiment. Eight subjects were dropped for not participating in both recall sessions and three were dropped at random (one each from 3 cells) to allow proportional cell frequencies. The result was a 2 (note taking/ reading) x 3 (grade level) x 2 (school) design with 12 subjects from school A and eight from school B in each of the six cells defined by the two note taking/ reading conditions and the three grade levels. Sex was not balanced between cells, but each cell contained approximately an equal number of males and females.

Materials

The materials consisted of a test booklet and a note taking booklet.

The first page of the test booklet served as a cover sheet and contained space for the subjects name, birth date, and a code defining his condition. The second page of the test booklet consisted of the memory instructions and the reading passage. The memory instructions read as follows:

> INSTRUCTIONS:
> You are going to read about different kinds of North American bears. You have to remember where in North

America each kind lives, what each kind eats, how fast each kind can run, and how much each kind weighs.

The reading passage was derived from the article on "bears" from the World Book Encyclopedia (1973).

Three criteria were used in deriving the passage. First, since an attempt was made throughout the experiment to keep conditions as much as possible like those of an actual school setting, the passage had to resemble "school-like" reading material. The bear topic was chosen because wild animals seem to be particularly interesting to children and because such topics are often contained in elementary science textbooks. The World Book Encyclopedia was chosen because of its wide reputation and use as a children's encyclopedia. The second criterion for choosing this passage was that it be of a suitable reading level for even the youngest children participating in the study. The passage had a readability level of 2.97 according to the formula proposed by Spache (1953). The third criterion for selecting this passage was that it contain facts relevant to the memory instructions as well as facts which could be considered irrelevant, (e.g. the bears' colour, temperment, commonality or swimming ability) with respect to the memory instructions. The passage was 222 words long and contained 21 facts about four kinds of bears' food, weight, speed, and location, as well as 12 irrelevant facts. It read as follows:

There are four kinds of North American bears. Brown Bears are the largest kind of bears on the world. They weigh 1500 pounds. They can be many colours, from yellowish to almost black. They are easily scared. Most Brown Bears live in Alaska. In the rivers of Alaska they find fish to eat. Brown Bears can run 20 miles per hour. Grizzly Bears weigh about 800 pounds. They get angry quickly. They use their claws to dig out ground squirrels and mice to eat. Grizzly Bears are fast and can run 30 miles per hour. Grizzly live mostly in Canada and Alaska. Like Brown Bears, Grizzly Bears' fur can be many colours, from yellowish to black. Black Bears are the most common bears. They are the smallest bears of North America and weigh only 500 pounds. They run 25 miles per hour. Not all Black Bears are black. Some are brown and others are creamy white. They eat all kinds of food. Black Bears live from Mexico to Canada. Polar Bears are good swimmers. Like Black Bears, Polar Bears can run 25 miles per hour. They are only a little smaller than Brown Bears. They weigh 1200 pounds. Their thick heavy fur is white. Polar Bears are good hunters and eat fish, seals, and walruses. Polar Bears live along the Arctic Ocean.

A pilot study indicated that previous knowledge of the relevant facts contained in this passage is minimal in children of grades 3, 5, and 7. In the pilot study, 17 of the relevant facts were replaced by blanks (e.g. Most Brown Bears live in_____. They find _____ to eat.) The four sentences containing information on the bears' running speed were not used. Subjects from grades 3, 5, and 7 were asked to fill in the blanks with the right word or words to complete the sentences. The mean number of correct answers was 1.00, 1.05, and 1.50 for subjects in grades 3, 5, and 7, respectively.

The third, fourth and fifth pages of the test booklet were blank, lined paper used for recall. When the

recall segment began, subjects turned over the test booklet and used these pages to write on. The first page (when the test booklet is turned over) was a blank unlined sheet of paper. The second page was a two inch strip on which was printed the first recall instruction, reading as follows: "Write down what you can remember about where the bears live, what they eat, how fast they run, and how much they weigh". The three blank pages used for recall followed.

The first page of the note booklet was a cover sheet. The next three pages were blank lined paper on which subjects wrote their notes.

Procedure

Subjects were tested in groups of 8 to 14. Each group consisted only of subjects in the same note taking condition and grade level. Subjects were seated separately at individual desks. On each desk, the experimenter had placed a test booklet and, if needed, a note booklet. Subjects were asked to write their name, birth date and whether they were a boy or a girl on each booklet.

Subjects were then introduced to the task by the experimenter who said:

> I am from the university and I am trying to find out which school in Essex County is the best at remembering. Today, I am going to find out how good your class can remember. Listen carefully to what I tell you to do because it is very important that you do exactly what I tell you.

The experimenter then explained the task itself to each of

the note taking groups as follows:

To the reading groups-

> You are going to read a story about bears and then you are going to be given some time to study what you have read. After you have finished studying, I am going to take the story away and ask you to write down what you remember. Any questions?

To the notes groups-

> You are going to read a story about bears. Then you will be given some time to study and make notes about what you have read. You will be given paper on which you should write down what you think is important to remember about the story. It is very important to write things down because the story is going to be taken away later and all that you will have to study from will be what you have written down. After you have finished studying, I am going to ask you to write down what you remember. Any questions?

The experimenter answered any questions and then told each group that if they finished studying before the time was up, they should read the story over again.

Following these instructions, all subjects were told to turn over the cover sheet of the test booklet. On this page were the memory instructions and the reading passage. The experimenter read both to the subjects at a rate of 50 words per minute, instructing them to read along silently with him. Subjects were then given 10 minutes to read, study, and take notes, according to the condition. The recall period followed the study period. Subjects were told to turn over the test booklet and turn the first page (the

blank unlined sheet of paper). The first recall instruction was then read to the subjects. Subjects were given 7 minutes to respond to this recall instruction. Following this first recall period, subjects were told to draw a line where they finished writing and start a new page. The experimenter then read the second recall instruction as follows- "Write down anything else that you can remember about the bears." Three minutes were given to repond to this recall instruction. Following this second recall period, subjects were dismissed.

A delayed test was given approximately three weeks after the initial testing day. All subjects from one class at one school were tested together. The subjects were given test booklets identical to original ones, but without the memory instructions and the reading passage. The subjects were reintroduced to the task by the experimenter and told they were going to be asked to write down what they remembered about the story they read three weeks earlier. The rest of the delayed test proceeded as in the initial testing. The first recall instruction was read to the subjects and 7 minutes allowed to respond to it. Following the first recall period, the second recall instruction was read to the subjects and 3 minutes allowed to respond to it. Subjects were then dismissed.

CHAPTER III

RESULTS

Scoring

Each subject's notes were scored for relevancy, efficiency, and irrelevancy according to the following rules. Relevancy was defined as the total number of relevant facts (here, relevant facts refers to the 21 attributes contained in the reading passage describing the bears' weight, food, location, and speed) discernably related to the proper type of bear (Black Bears, Polar Bears, Brown Bears, and Grizzly Bears). When more than one fact defines the relationship between a type of bear and an attribute (e.g. Grizzly Bears eat squirrels and mice), each fact was counted separately. The efficiency score was calculated by dividing the relevancy score by the total number of words contained in the notes. In determining the number of words, all words counted, including articles and abbreviations. Irrelevancy was defined as the total number of irrelevant facts (referring here to the 12 attributes contained in the reading passage describing the bears' colour, temperament, etc.) discernably related to the proper type of bear plus the number of relationships which were either undiscernable or in error. Again, where there were multiple attributes (Grizzly Bears can be yellowish or black) each was counted separately.

Recall protocols obtained in both the immediate and delayed testing sessions were scored. Protocols for the first recall instruction were scored for number of relevant facts correctly recalled, while those for the second recall instruction were scored for nonrelevant facts correctly recalled. The relevant facts score was determined by applying the rule for deriving note relevancy. The nonrelevant facts score was determined by applying the rule for deriving note irrelevancy, except that here, undiscernable or incorrect relationships were not counted. In all scoring, spelling did not need to be exact.

Data from 20% of the subjects in each cell were scored by an independant scorer. Reliability scores were over 90% for the nonrelevant facts scoring and over 95% for all other scoring. All interscorer *r* s were over .98.

Note Characteristics

The primary purpose of the present study was to determine the characteristics of notes taken by children of different ages while reading and studying a prose passage. Of principle interest were note relevancy, note efficiency and note irrelevancy. Data regarding each of these characteristics were analyzed using separate 3 (grade level) x 2 (school) proportionally weighted means analysis of variance. Proportionally weighted means analyses were used because the number of subjects in each

condition at school A was 12, while at school B it was 8.

The mean relevancy scores are presented in Table 1. The ANOVA for these data is summarized in Table 2. Only the main effect of grade level was significant ($p < .001$). No main or interactive effects resulting from the differences between schools were found to be significant ($p > .05$). The effect of grade level was investigated further using Duncan's multiple range test. Note relevancy was higher at grade 7 than at grade 5 ($p < .001$) which, in turn, was higher than at grade 3 ($p < .001$).

The mean efficiency scores are presented in Table 3. The ANOVA for these data is summarized in Table 4. Again, only the main effect of grade level was significant ($p < .001$). Using Duncan's multiple range test, it was found that grade 7 subjects had higher efficiency scores than grade 5 subjects ($p < .001$) who, in turn, had higher scores than grade 3 subjects ($p < .05$).

The mean irrelevancy scores are presented in Table 5. The ANOVA for these data is summarized in Table 6. Again, only the main effect of grade level was significant ($p < .001$). Further analysis indicated that note irrelevancy scores were higher at grade 7 than at grade 5 ($p < .05$) which, in turn, were higher than at grade 3 ($p < .01$).

At the outset of this study it was expected that the characteristics of the notes children take would show

TABLE 1

RELEVANCY SCORES

School	Grade 3	Grade 5	Grade 7
School A	6.00 (3.54)	11.75 (5.17)	19.00 (3.69)
School B	1.86 (2.17)	11.86 (5.69)	20.12 (0.99)
Combined	4.35 (3.65)	11.80 (5.24)	19.45 (2.93)

Note.--Standard deviations are in parentheses.

TABLE 2

ANALYSIS OF VARIANCE:
RELEVANCY SCORES

Source	SS	df	MS	F
Grade (G)	2280.23	2	1140.12	72.53 *
School (S)	13.22	1	13.22	0.84
G x S	74.60	2	37.30	2.37
within cells	848.88	54	15.72	

* $p < .001$.

TABLE 3

EFFICIENCY SCORES

School	Grade 3	Grade 5	Grade 7
School A	0.096 (.052)	0.140 (.081)	0.244 (.109)
School B	0.070 (.083)	0.128 (.050)	0.208 (.030)
Combined	0.086 (.065)	0.135 (.069)	0.229 (.086)

Note.--Standard deviations are in parentheses.

TABLE 4

ANALYSIS OF VARIANCE:
EFFICIENCY SCORES

Source	SS	df	MS	F
Grade (G)	0.204	2	0.107	18.99 *
School (S)	0.009	1	0.009	1.52
G x S	0.001	2	0.001	0.12
within cells	0.303	54	0.006	

* $p < .001$.

TABLE 5

IRRELEVANCY SCORES

School	Grade 3	Grade 5	Grade 7
School A	3.75 (3.42)	5.42 (2.54)	7.08 (4.25)
School B	1.12 (1.64)	5.62 (3.25)	8.38 (1.60)
Combined	2.70 (3.08)	5.50 (2.76)	7.60 (3.44)

Note.--Standard deviations are in parentheses.

TABLE 6

ANALYSIS OF VARIANCE:
IRRELEVANCY SCORES

Source	SS	df	MS	F
Grade (G)	241.73	2	120.87	12.83 *
School (S)	2.02	1	2.02	0.22
G x S	39.27	2	19.63	2.08
within cells	508.71	54	9.42	

* $p<.001$.

developmental trends. In addition, it was expected that the number of relevant facts recorded and the amount of relevant information per written word would increase with age while the number of irrelevant facts would decrease.

As the above data indicate, these expectations were largely confirmed. Developmental trends were observed for each of the three note characteristics. However, while note relevancy and note efficiency did increase with age, so also, did note irrelevancy. This was opposite to the result expected for irrelevancy. It is of note, however, that while the absolute number of irrelevant facts recorded in the notes did increase with age, there was a steady, though non-significant (F (2,57)$=$ 0.86, $p > .10$), decrease in the percentage of irrelevant facts recorded (i.e. irrelevancy divided by relevancy plus irrelevancy). For third graders, the mean percentage was 36.7%, for fifth graders, the mean percentage was 32.1%, and for seventh graders it was 26.9%.

Several other observations concerning the subjects note taking behaviours should also be noted. First, the reading passage itself was highly organized and the notes of most subjects at all grade levels tended to reflect this organization. However, among third grade subjects, five ignored the information in the passage and wrote stories on their own observations of bears (e.g. "I am afraid of bears"; "Bears are very big"); seven other grade 3 subjects attempted to record the passage word for word. Hence, only

eight third graders attempted any editing or paraphrasing of the information. Among fifth graders, six subjects copied word for word and 14 edited or paraphrased, while all 20 seventh grade subjects edited or paraphrased. The difference between grades 5 and 7 was significant ($\underline{x}^2 = 7.06$, $\underline{p} < .01$), while between grades 5 and 3 it was marginally significant ($\underline{x}^2 = 3.64$, $.05 < \underline{p} < .10$).

Second, the subjects were restricted to only 10 minutes for studying and taking notes. It might be assumed that the age related differences in note characteristics were due to the ability of older subjects to write more words within this period. The data only partially confirm this assumption. The mean number of words written in the notes differed due to grade level ($\underline{F}$ (2, 57)= 22.058, $\underline{p} < .001$; see Table 7). However, the number of words written by grade 5 subjects ($\underline{X}$= 90.10, $\underline{S.D.}$= 27.49) and by grade 7 subjects ($\underline{X}$= 90.45, $\underline{S.D.}$= 18.87) did not differ ($\underline{p} > .05$), though both wrote more words than did grade 3 subjects ($\underline{X}$= 48.75, $\underline{S.D.}$= 21.26; $\underline{p} < .001$ for both comparisons). This would seem to indicate that at least the differences in note characteristics at grades 5 and 7 cannot be attributed to the writing of more words by older subjects.

Finally, it was informally observed that most seventh graders finished their notes before the 10 minute period was over, most fifth graders worked throughout the period and most third graders alternated working on their

TABLE 7

ANALYSIS OF VARIANCE: WORDS WRITTEN IN NOTES.

Source	SS	df	MS	F
Grade	22992.31	2	11496.15	22.06*
within cells	29706.50	57	521.17	

* $p < .001$.

notes and engaging in non-task relevant or distracting behaviour, such as looking around the room.

Note Characteristics and Recall

A second purpose of the present study was to determine the relationship between note characteristics and recall. Several studies of adult note taking appeared to suggest that significant correlations may exist between note characteristics and aspects of recall. For instance, note relevancy and efficiency might be positively correlated with the number of relevant facts recalled while note irrelevancy might be negatively correlated with recall.

Table 8 presents the correlational data obtained in the present study. Within each grade level, Pearson product moment coefficients were calculated between each of the three note characteristics and: (1) the number of relevant facts correctly recalled (in response to the first recall instruction); and (2) the number of non-relevant facts correctly recalled (in response to the second recall instruction). Both the immediate and delayed tests were analyzed in this manner. Four significant correlations were found ($p < .05$): in the immediate test, note irrelevancy correlated with relevant facts recalled at grade 7 (.511) and with non-relevant facts recalled at grade 5 (.456). In the delayed test, relevant facts recalled correlated with relevancy (.492) and efficiency (.550), both at grade 5.

TABLE 8

PEARSON PRODUCT-MOMENT CORRELATIONS
BETWEEN NOTE CHARACTERISTICS
AND RECALL

	Relevancy			Efficiency			Irrelevancy		
Test	Gr 3	Gr 5	Gr 7	Gr 3	Gr 5	Gr 7	Gr 3	Gr 5	Gr 7
				Relevant facts					
Imm	.40	.31	.38	.02	.18	-.24	-.22	-.07	.51*
Del	.42	.49*	.18	.22	.55*	.04	.10	.14	.09
				Non-relevant facts					
Imm	.36	.21	.36	.13	.01	.03	.04	.46*	.20
Del	.25	.34	.14	.07	.00	-.13	.10	.22	.04

Note.--Abbreviations are as follows: Gr--grade; Imm--immediate; Del--delayed.

*$p < .05$.

It is important to note, however, that Table 8 contains 36 correlations. With such a number, one would expect that chance factors alone would result in, on average, 1.8 significant correlations at $p < .05$. It is likely, then, that one or more of the significant correlations in Table 8 are random events.

Although there appears to be little evidence of a pattern to the significant correlations reported in Table 8, (at least not one readily predictable or suggested by studies of adult note taking), it is noteworthy that in five of six instances, note relevancy correlated moderately (although only one correlation was significant) with the number of relevant facts recalled. In addition, the probability (the number of occurances divided by the number of possible occurances) of recalling an item that appeared in the notes was, in general, greater than the probability of recalling an item that did not appear in the notes. These probabilities are presented in Table 9 by grade level. These data indicate that an item recorded in the notes was more likely to be recalled than was an item not recorded in the notes. Hence, there would appear to be some evidence, albeit weak, of a positive relationship between note relevancy (i.e. the number of relevant facts recorded in the notes) and the number of relevant facts recalled.

TABLE 9

MEAN PROBABILITIES OF RECALLING
RELEVANT FACTS APPEARING
(a) IN THE NOTES AND
(b) NOT IN THE NOTES

	Grade 3		Grade 5		Grade 7	
	(a)	(b)	(a)	(b)	(a)	(b)
	Immediate test					
Number facts recalled	2.45	2.10	7.53	2.37	12.00	0.55
Probability of recall	.56	.13	.64	.26	.62	.35
	Delayed test					
Number facts recalled	0.45	1.02	4.06	1.22	5.18	0.49
Probability of recall	.10	.06	.34	.13	.27	.32

Note.--The number of relevant facts recalled that also appeared in the notes are found in the column marked (a). The number of relevant facts recalled that did not also appear in the notes are found in the column marked (b). Probabilities in column (a) equal the mean number of items recalled that also appeared in the notes divided by the mean number of items appearing in the notes. Probabilities in column (b) equal the mean number of items recalled that did not appear in the notes divided by the mean number of items not appearing in the notes.

Note Taking versus Reading

A third purpose of the present study was to compare the effect on recall of preparing notes while reading and studying a passage with the effect on recall of reading and studying without taking notes. Separate 3 (grade level) x 2 (note taking/ reading) x 2 (school) proportionally weighted means analyses of variance were used to analyze the number of relevant facts and the number of nonrelevant facts correctly recalled in the immediate and in the delayed tests.

The mean numbers of relevant facts recalled on the immediate test are presented in Table 10. The ANOVA for these data is summerized in Table 11. The main effect of grade level was found to be significant. This effect was due to the fact that grade 7 subjects recalled more than did grade 5 subjects ($p < .001$), who in turn recalled more than did grade 3 subjects ($p < .001$). The interaction of grade level and condition was also significant and is depicted graphically in Figure 1, with data collapsed across schools. As can be seen from Figure 1, the interaction resulted from a reversal of the effects of taking notes and reading at grades 7, At grade 7, note takers recalled fewer relevant facts than did readers (F (1, 108)= 13.540, $p < .001$). However at grade 5 note takers recalled more relevant facts than did readers (F

TABLE 10

RELEVANT FACTS RECALLED:
IMMEDIATE TEST

School	Grade 3	Grade 5	Grade 7
	Note taking condition		
School A	4.67 (3.17)	8.75 (2.56)	12.25 (3.42)
School B	4.38 (2.56)	11.62 (2.67)	13.00 (3.85)
Combined	4.55 (2.87)	9.90 (2.92)	12.55 (3.52)
	Reading condition		
School A	4.00 (2.92)	7.92 (3.42)	15.50 (5.09)
School B	3.75 (2.82)	5.50 (2.78)	17.88 (3.48)
Combined	3.90 (2.81)	6.95 (3.33)	16.45 (4.57)

Note.--Standard deviations are in parentheses.

TABLE 11

ANALYSIS OF VARIANCE: RELEVANT FACTS RECALLED ON THE IMMEDIATE TEST

Source	SS	df	MS	F
Grade (G)	2134.95	2	1067.48	95.03 *
Condition (C)	0.30	1	0.30	0.03
School (S)	7.40	1	7.40	0.66
G x C	243.04	2	121.52	10.82 *
G x S	17.24	2	8.62	0.77
S x C	10.51	1	10.51	0.94
G x S x C	63.06	2	31.53	2.81
within cells	1213.21	108	11.23	

* $p < .001$.

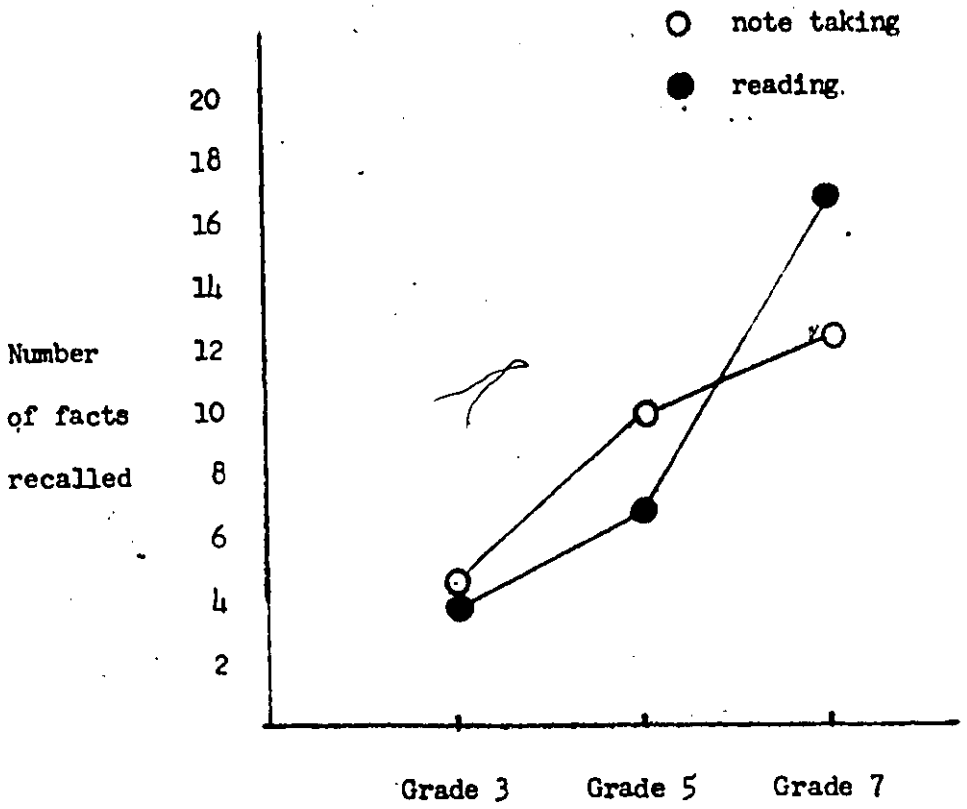

Fig. 1. Number of relevant facts recalled on the immediate test by grade level and study condition, collapsed across schools.

(1, 108)= 7.747, $p < .01$). The difference at grade 3 was not significant (F (1, 108)= 1.622, $p > .05$). Simple effects of grade level were also found within the note taking condition (F (2, 100)= 47.788, $p < .001$) and within the reading condition (F (2, 100)= 76.280, $p < .001$). Within the note taking condition, grade 7 subjects recalled more relevant facts than did grade 5 subjects ($p < .05$) who in turn recalled more than did grade 3 subjects ($p < .001$). Within the reading condition, grade 7 subjects recalled more relevant facts than did grade 5 subjects ($p < .001$) who recalled more than did grade 3 subjects ($p < .005$).

The mean numbers of relevant facts recalled on the delayed test are presented in Table 12. The ANOVA for these data is summarized in Table 13. Results similar to the immediate test were found. Grade 7 subjects recalled more than did grade 5 subjects ($p < .001$) who recalled more than grade 3 subjects ($p < .001$). An interaction, similar to that observed in the immediate test data, was found to be significant in the delayed test data and is depicted in Figure 2. At grade 7, a trend was found indicating that note takers recalled fewer relevant facts than readers (F (1, 108)= 3.862, $.05 < p < .10$). At grade 5, note takers recalled significantly more than readers (F (1, 108)= 9.194, $p < .005$). The difference was not significant at grade 3 (F (1, 108)= 0.003, $p > .10$). Significant simple effects were found within the note taking condition

TABLE 12

RELEVANT FACTS RECALLED:
DELAYED TEST

School	Grade 3	Grade 5	Grade 7
	Note taking condition		
School A	1.67 (1.44)	6.00 (4.07)	5.83 (2.29)
School B	1.12 (1.25)	4.25 (4.10)	5.38 (3.02)
Combined	1.45 (1.36)	5.30 (4.07)	5.65 (2.54)
	Reading condition		
School A	1.67 (2.06)	2.58 (3.26)	6.58 (2.78)
School B	1.25 (1.49)	2.62 (2.07)	8.62 (3.93)
Combined	1.50 (1.82)	2.60 (2.78)	7.40 (3.35)

Note.—Standard deviations are in parentheses.

TABLE 13

ANALYSIS OF VARIANCE: RELEVANT FACTS RECALLED ON THE DELAYED TEST

Source	SS	df	MS	F
Grade (G)	510.18	2	255.06	32.17*
Condition (C)	2.70	1	2.70	0.34
School (S)	0.94	1	0.94	0.12
G x C	100.85	2	50.42	6.36**
G x S	14.29	2	7.14	0.90
S x C	15.60	1	15.60	1.97
G x S x C	7.14	2	3.57	0.45
within cells	856.334	108	7.93	

* $p < .001$.

** $p < .005$.

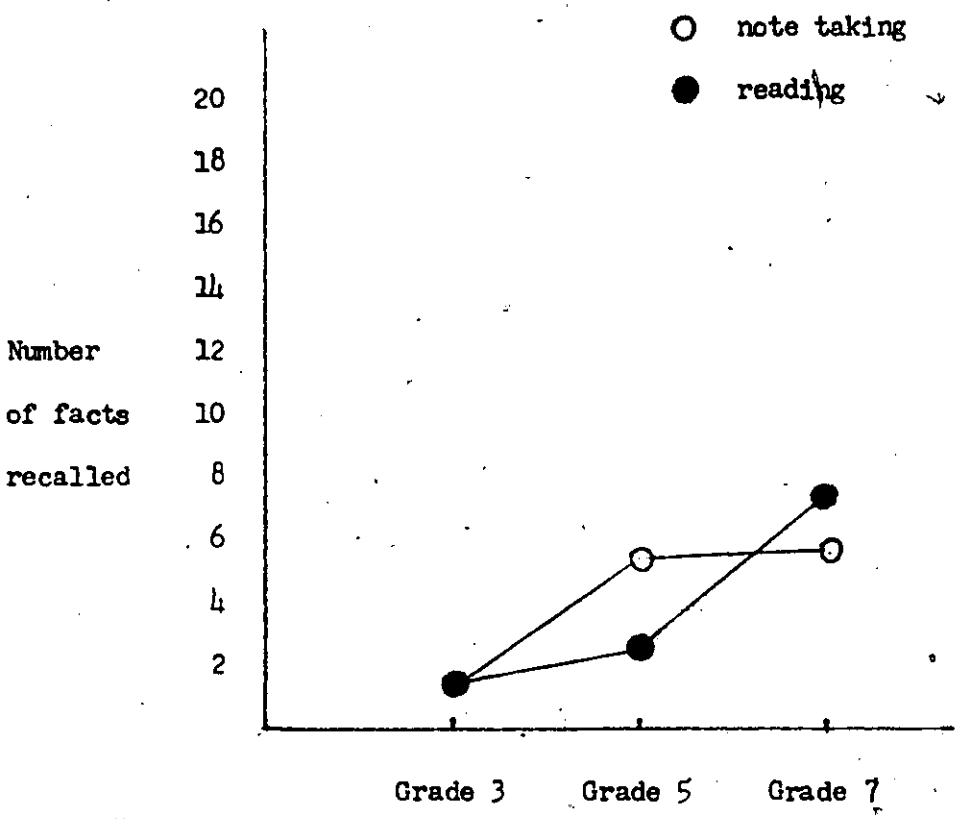

Fig. 2. Number of relevant facts recalled on the delayed test by grade level and study condition, collapsed across schools.

(F (2, 108)= 13.698, $p < .001$) and within the reading condition (F (2, 108)= 24.828, $p < .001$). Within the note taking condition, grade 7 subjects did not differ from grade 5 subjects ($p > .05$) who did recall more than grade 3 subjects ($p < .001$). Within the reading condition, grade 7 subjects recalled more than did grade 5 subjects ($p < .001$) who did not differ from grade 3 subjects ($p > .05$).

The conditions of note taking and reading were also compared for their influence on the recall of non-relevant information. The mean numbers of non-relevant facts recalled on the immediate test are presented in Table 14. The ANOVA for these data is summerized in Table 15. Only the main effect due to grade level was significant. Grade 7 subjects recalled more non-relevant facts than did grade 5 subjects ($p < .005$) who recalled more than did grade 3 subjects ($p < .01$). The mean number of non-relevant facts recalled on the delayed test is presented in Table 16. The ANOVA for these data is summarized in Table 17. Again, only the main effect due to grade level was significant. Grade 7 subjects recalled more non-relevant facts than did grade 5 subjects ($p < .05$) who recalled more than grade 3 subjects ($p < .005$). In all cases, the number of non-relevant facts recalled (out of a possible 12) was small. However, the test period for recall of non-relevant facts was only three minutes.

TABLE 14

NON-RELEVANT FACTS RECALLED:
IMMEDIATE TEST

School	Grade 3	Grade 5	Grade 7
	Note taking condition		
School A	0.42 (1.00)	1.33 (1.72)	2.50 (2.47)
School B	0.12 (0.35)	2.25 (3.01)	2.50 (2.00)
Combined	0.30 (0.81)	1.70 (2.30)	2.50 (2.24)
	Reading condition		
School A	0.08 (0.29)	1.33 (2.06)	3.17 (2.76)
School B	0.38 (0.74)	0.75 (1.49)	2.62 (1.60)
Combined	0.20 (0.52)	1.10 (1.83)	2.95 (2.33)

Note.--Standard deviations are in parentheses.

TABLE 15

ANALYSIS OF VARIANCE: NON-RELEVANT FACTS RECALLED ON THE IMMEDIATE TEST

Source	SS	df	MS	F
Grade (G)	122.72	2	61.36	17.84*
Condition (C)	0.21	1	0.21	0.06
School (S)	0.04	1	0.04	0.01
G x C	5.52	2	2.76	0.80
G x S	0.94	2	0.47	0.14
S x C	1.70	1	1.70	0.50
G x S x C	5.22	2	2.61	0.76
within cells	371.46	108	3.44	

* $p<.001$.

TABLE 16

NON-RELEVANT FACTS RECALLED:
DELAYED TEST

School	Grade 3	Grade 5	Grade 7
	Note taking condition		
School A	0.83 (0.84)	2.08 (2.06)	2.50 (1.51)
School B	0.75 (0.89)	3.00 (2.78)	3.25 (1.91)
Combined	0.80 (0.84)	2.45 (2.35)	2.80 (1.67)
	Reading condition		
School A	1.08 (1.16)	1.42 (1.00)	2.75 (2.09)
School B	1.00 (1.41)	1.88 (1.25)	3.12 (1.46)
Combined	1.05 (1.23)	1.60 (1.10)	2.90 (1.83)

Note.--Standard deviations are in parentheses.

TABLE 17

ANALYSIS OF VARIANCE: NON-RELEVANT FACTS RECALLED ON THE DELAYED TEST

Source	SS	df	MS	F
Grade (G)	74.62	2	37.31	14.47 *
Condition (C)	0.83	1	0.83	0.32
School (S)	4.36	1	4.36	1.69
G x C	7.12	2	3.56	1.38
G x S	3.29	2	1.64	0.64
S x C	0.56	1	0.56	0.22
G x S x C	0.29	2	0.14	0.06
within cells	278.42	108	2.58	

* $p < .001$.

CHAPTER IV

DISCUSSION

Note Characteristics

The focus of the present study was on the practice of preparing notes on material that is being studied. Several recent investigators (e.g. Howe, 1970; DiVesta and Gray, 1972; 1973) have called for a close examination of the characteristics of the notes prepared. These investigators have argued that such an examination might provide considerable information on the cognitive processes underlying the learning of meaningful material (DiVesta and Gray, 1973). The characteristics of the notes prepared by children have not yet been examined. Therefore, the primary purpose of the present study was to construct a description of the notes taken by children of various ages.

It was found that the notes taken by older children tended to contain more relevant facts and more irrelevant facts than did the notes taken by younger children. The ratio of relevant facts to the total words contained in the notes also increased with age. It might reasonably be assumed that older children can write more words in a 10 minute period (the length of the study period used in the present investigation) than can younger children and that, therefore, the observed differences in these note characteristics merely reflected this greater ability. However,

the number of words written by fifth and seventh graders did not differ (both did, however, write more than third graders), indicating that the age differences in note characteristics can not be attributed solely to the assumed greater writing speed of older children. Older children were not merely writing in the allotted time, but they were also writing it differently. Further supporting this conclusion were the findings that the number of subjects either copying verbatim or ignoring the information contained in the passage steadily decreased with age, as did the percentage of irrelevant facts recorded in the notes (though this latter decrease was nonsignificant).

Just what factors accounted for the age related differences in what may be called "note taking style" were not uncovered in the present study. It can be speculated, however, that these factors most likely included either or both of the following. First, with increasing age (at least through the childhood years), there is likely to be an increase in the ability to utilize the skills required to solve a given task. In the present experiment, the task required, among other skills, selectively attending to the material being studied. The learner was required to concentrate on the relevant facts at the expense of the irrelevant facts. Some aspects of the observed age related differences in "note taking style"

(e.g. the increase, with age, in relevancy scores) may have reflected an increasing ability to selectively attend to relevant information. Second, as the child matures, there is likely to be an increase in the ability to correctly match the task at hand with the proper skills required to solve that task, that is, to choose from the child's repertoire of skills those which will most likely facilitate success in the task. In the present experiment, one such matching problem presented the learner was the need to match the recording of relevant facts with the opportunity to study what was recorded in the notes once the study booklet had been removed. If this was not done, then the subject would deprive himself of the opportunity to study the material once the booklet was removed. The age related increase in relevancy scores may have reflected an increasing awareness of this need and how to meet it.

It is not known how or why such factors develop. However, Hagen (1972) has offered a real-life developmental framework which, to the present author, seems quite plausible, and is consistent with the present argument. It is best stated in his own words as follows:

> It seems reasonable that children develop more efficient means of coping with task situations because, as they grow older, increasing demands are made upon them to improve performance and to produce correct answers. Reward for correct performance is offered very early in a child's life, and one can imagine that the young child soon

> becomes concerned with obtaining his share of available rewards. Task demands are made increasingly explicit and require more differentiated responses as children get older. School provides a fresh source of feedback concerning correctness or incorrectness and furnishes norms for performance in relation to the behaviour of others. But the child is also learning that he plays the key role in how well he does, and that he can improve his performance if he approaches certain kinds of tasks in certain ways. Those cues which achieve salience for him receive the most attention, and are approached with the available response modes. (p. 129)

Thus, changes in "note taking style" (and perhaps other study habits as well) seem to be closely related to changes occuring in the child's world, especially in school. Progress in school requires that the child become increasingly proficient at skills required to solve certain tasks. In addition, the nature of the tasks themselves becomes increasingly differentiated (e.g. going from the relatively unitary study of reading at grade 1, to the more differentiated studies of grammar and literature at grade 6) and the child must also learn that a skill appropriate for one type of task may not be appropriate for another type of task.

Note Characteristics and Recall

A second purpose of the present study was to explore the relationship between three characteristics of children's notes and the learning of prose material. The findings indicated four significant correlations out of a

possible 36. The lack of a discernable pattern to the significant correlations makes any explanation of each individual significant correlation subject to question. This is especially true in light of the fact that with 36 correlations, chance factors alone could account for approximately two (on the average) significant correlations. It seems likely, then, that the three note characteristics, given the definitions and note taking instructions used here, are poor predictors of young children's recall of prose material in a school setting.

One possible exception is the relationship between note relevancy and the number of relevant facts recalled. Out of six correlations calculated between relevancy and relevant facts recalled, one was significant and four were moderate, though nonsignificant (from .309 to .424). This seems consistent with reports of positive correlations between the number of points recorded in a subject's notes of a spoken lecture and the number recalled. The correlations were on the order of .33 to .66 (Crawford, 1925a) and .42 to .53 (Fisher and Harris, 1973). In addition, the present study replicated reports by Howe (1970)and Crawford (1925a) in finding that facts which were recorded in the subjects' notes had a higher probability of being recalled than did facts not appearing in the subjects' notes. These findings suggest that those facts which were recorded

in the notes were more likely to be encoded into memory than were those facts which were not recorded in the notes. It is not clear why this should be so, however it may be speculated that facts which were selected out to be recorded in the notes, may have been rehearsed more, and may have received more attention, than did facts not selected for recording in the notes. The extra attention given to items recorded in the notes may have facilitated their encoding into memory. In addition, it is interesting to note that practical guides to studying often state that the extra attention given to items recorded in a subject's notes, in his own words, is one reason note taking facilitates learning. For example, Morgan and Deese (1957) state that note taking

> ...forces you to participate actively in the learning process. If you try to write down briefly what the author says, you can't help but make it part of your own mental processes.... Hence the chances of your remembering what you read are increased many-fold. (pp.56-58)

As for why the correlations between relevancy and relevant facts recalled did not reach significance in the present study, it seems reasonable to suspect that the correlations reported include considerable "noise" resulting, for example, from factors left uncontrolled in the naturalistic setting used in the experiment (e.g. the number of subjects tested at one time varied, as did the rooms used for testing).

Note Taking and Reading

Note taking is often recommended as a practical means of improving recall in educational settings (e.g. Morgan and Deese, 1957; Pauk, 1962). The present study set out to determine if this recommendation was valid for elementary school children, at least under the special definitions and constraints of this experiment. It was found that seventh graders who studied by reading the passage without taking notes recalled more relevant facts than did seventh graders who took notes, while in grade 5 it was the note takers who recalled more. There was no difference between conditions at grade 3. In addition, these differences were stable enough to reappear on a delayed test, some three weeks after original exposure to the prose passage.

It is clear from Figures 1 and 2 that note taking affected recall differently than did reading and studying without taking notes. Equally apparent from these figures is the fact that the effect of note taking varied with the grade level tested. However, an explanation of this effect is not clear. Why, in the present experiment, did note taking facilitate recall at grade 5, but interfere with recall at grade 7 and have no effect at grade 3? Several explanations come to mind, though without further research none can be given more than speculative value. In addition, the reliability of the results reported here can not be assumed without further

replication. (In this respect, it is noteworthy that no school effects were found in the present study. This may be construed as a replication over two schools.)

The most likely explanation centers on the instructions for the note taking condition. These contained the statement "It is very important to write things down because the story is going to be taken away later and all that you will have to study from will be what you have written down." This statement was originally included to heighten the subjects' motivation to take notes. However, it may have interacted with grade level so as to produce different note taking strategies. Seventh graders, who might be expected to pay more attention to details when instructions are being given, prepared notes for use at some later time, without actually spending much time studying the material itself. Hence, when not allowed to use their notes later, their recall was poorer than that of seventh grade readers who spent the entire 10 minutes studying. Grade 5 subjects may have ignored the instruction about later use, and their notes may have served more as an encoding device (as opposed to the external storage device of the seventh graders). At grade 5, using notes as an encoding device may have facilitated the encoding of relevant facts, compared to encoding by reading, and this difference may have produced the difference between

conditions observed at this grade level. Some merit is given to this argument by the informal observation that seventh grade subjects in the note taking condition seemed to engage in distracting behaviour (e.g. looking around the room) after they had finished their notes. It is as if, after finishing their notes, they thought the task was completed and waited for the review period to begin. Seventh grade readers seemed to read the passage throughout the study period. This same difference was not noticed in fifth graders. Here, subjects in both conditions worked throughout the study period. As for grade 3, where no difference was found between conditions, subjects, either with or without the aide of notes, may not have possessed the skills required by the task (e.g. selectively attending to relevant facts) and/ or they may not have been able to match these skills to the demands of the task. In both conditions, subjects did not appear to pay much attention to the task (perhaps it was too different from their usual school experience) and recall was relatively low (about 4 items).

A second explanation is that the task itself was fairly easy for seventh graders. The passage was below third grade readability and there were only 21 facts to remember, neatly grouped in the passage into four categories. It may be that subjects in the reading condition

were able to effectively utilize their own strategies for learning. The extra time and effort required to prepare notes may have distracted the note taking subjects from engaging in the same strategies, and hence produced the deficit in recall. If a more difficult task were used for these subjects (e.g. by increasing the number of facts or changing the passage organization), note taking might facilitate recall. On the other hand, fifth graders may not have developed their own strategies to the point where they are able to extract the necessary information by reading the passage. Here, preparing notes (or some facet of taking notes, such as actually writing the material) may be a more effective strategy than reading. Again, third graders recalled very few items, and the task may have been too difficult in either condition for them to handle.

A third explanation is that the result reflects the effect of variables other than the independant variable (note taking) manipulated here. Studies of adult note taking are notable in that the results reported generally disagree as to whether note taking facilitates recall. In most of these studies, subjects were tested in groups but the unit of analysis was still the individual subject. This was also the case in the present study. However, this unit of analysis may be incorrect, for, even when the experimenter attempts to keep conditions as similar as possible

for all groups, factors created by the dynamics of the individual groups themselves may overshadow the effects (if any) of the variables manipulated by the experimenter. Therefore, future studies should give consideration to using the group mean as the basic unit of analysis.

Finally, differences between study conditions produced no effect on the number of non-relevant facts recalled, although recall of these facts did increase with grade level in both conditions. The lack of differences between conditions is most likely due to the short (only 3 minutes) period used for recalling non-relevant facts. It is also possible that since most non-relevant facts dealt with the bears' colour, what was actually tested was the previous knowledge of the subjects. The differences between conditions would not be expected to influence previous knowledge.

Concluding Comments

The present study focused on the characteristics of children's notes. An attempt was made to describe these characteristics and to determine their relationship to the recall of factual information. Before this study was undertaken, little was known about how children would respond to the task of preparing notes. Many questions still remain to be answered, but a start has been made. First, the development of note taking (and possibly other study aides)

appears to involve an increase in the ability to utilize the skills required and/or an increase in the ability to match the required skills to the task. The development of these abilities may, in turn, be related to the nature of the child's experiences in school. In this respect, it may prove beneficial to examine the impact of current teaching techniques on the development of note taking. Second, note characteristics are rather poor predictors of recall. Note relevancy may prove better, but just how good a predictor it can be and what is the nature of its relationship to recall await future investigations. Third, instructions to take notes affect recall in the primary grades, but this effect varies with age. Why this is so and what mechanisms produce the effect are not known. There does appear, then, to be some evidence, both from the developmental changes in note characteristics and from the effect of note taking on recall, to implicate the use of note taking in the study in the study of prose learning. A close examination of the conditions (e.g. difficulty and nature of tasks, age of subjects) under which note taking does and does not affect prose learning and/or note characteristics may prove a potent source of hypotheses not only on the development of prose learning, but also on the influence of various instructional technique on such development.

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APPENDIX A

Review of Literature

REVIEW OF LITERATURE

This review examines those experiments which deal with the practice of taking notes while attending to meaningful verbal material which is to be remembered. Traditionally, such such experiments have sought to determine the efficacy of note taking as a study aid. Contrasts are usually made between taking notes while attending to the material and attending to it without taking notes, though occasionally note taking is contrasted with other suspected study aids (e.g. outlining or underlining). Evidence with respect to the superiority of note taking over these various other study techniques is mixed. This is due, at least in part, to the vast differences in procedure that exist among the various studies and, in part, to the relatively few studies that have dealt with the topic (many of them were conducted before the advent of modern statistical methods). The present review is an attempt to bring some order to the confusion that exists. Of central concern are three procedural variables believed by the present author to be largely responsible for the mixed results that have been reported. These variables are: (1) whether or not there was an opportunity to review the notes before testing; (2) the manner in which the to-be-learned material was presented, i.e. whether it was listened to or read; and (3) the manner in which recall of the material was tested, i.e. cued recall

(e.g. objective tests, "fill-in-the-blanks" tests) or free recall (e.g. essay questions, instructions to "write down everything remembered").

At this time, the reader's attention is called to Table 18. This table lists studies reporting evidence favorable or unfavorable to the superiority of note taking over various other study techniques, according to the procedural variables used. The following review will make reference to Table 18 at various times.

Note Taking with Review

As can be seen from Table 18, those studies (the top half of Table 18) providing and opportunity for reviewing the notes taken offer fairly consistent support for the superiority of note taking as opposed to studying without notes, while without a review period the evidence is more mixed (the bottom half of Table 18). However, and argument can be built that studies contrasting note taking without review and attending to the material are not directly comparable to those contrasting note taking with review and attending to the material. First, there are at least two methodological problems characteristic of studies involving a review period but not encountered in studies having no review period. (a) There is the problem of equating attention to the study material, i.e. equating the amount of time note takers and non-note takers spend actually studying the

TABLE 18

EXPERIMENTS INVESTIGATING THE EFFECT OF NOTE TAKING ON RECALL

Note taking with review							
Listening				Reading			
Supporting		Not supporting		Supporting		Not supporting	
Free	Cued	Free	Cued	Free	Cued	Free	Cued
Crawford 1925b 4	Crawford 1925b 5	Eisner & Rohde 1959	Crawford 1925b 6				
Crawford 1925b 5	DiVesta & Gray 1972		DiVesta & Gray 1973 1 i				
Crawford 1925b 6	DiVesta & Gray 1973 1 d		DiVesta & Gray 1973 2 i				
Crawford 1925b 7	DiVesta & Gray 1973 2 d		Eisner & Rohde 1959 id				
DiVesta & Gray 1972	Fisher & Harris 1973 i						
DiVesta & Gray 1973 1							
DiVesta & Gray 1973 2							
Fisher & Harris 1973							

TABLE 18 (continued)

Note taking without review							
Listening				Reading			
Supporting		Not supporting		Supporting		Not supporting	
Free	Cued	Free	Cued	Free	Cued	Free	Cued
Crawford 1925b 1.	Fisher & Harris 1973 i	Noall 1962 1 id	Crawford 1925b 2		Dynes 1932 id	Todd & Kessler 1971	Arnold 1942 id
Crawford 1925b 2			Crawford 1925b 3			Schultz & DiVesta 1972	Stordahl & Christersen 1956 id
Crawford 1925b 3			McClendon 1958 id				Noall 1962 2 id
Fisher & Harris 1973			Fisher & Harris 1973 d				

Note.--Experiments are listed as either supporting or not supporting the superiority of note taking while attending to study material without taking notes. When a study reports more than one experiment, the individual experiments are identified by numbers following the date of the study. When immediate and delayed tests of the same type were used, this is indicated by i and d, respectively. "Listening" and "Reading" identify the nature of the to-be-learned material. "Free" and "Cued" identify the type of recall test used.

material. In studies with a review period, note takers get to review the notes they have made while non-note takers are usually instructed to "mentally review" the material studied. However, in the naturalistic setting of the classroom (most note taking studies have used such a setting), it is easier to imagine the mental reviewers as having more difficulty attending to their task than the note reviewers. Note reviewers have something concrete before them to command their attention and keep their minds (and eyes) from wandering about the classroom, whereas mental reviewers do not. (b) There is also a problem of the availability of the material to be reviewed. Again, it is easier to imagine the mental reviewers as having less material available to review as they must first recall it, unaided, in order to review it, while the note reviewers have a written record to aid in their review. Without a review period these problems do not exist, as recall testing takes place without an opportunity for either group to review the material once the learning period is over. A second reason the two types of studies are not directly comparable is that studies with or without a review period seem to be asking two different questions. The one is the practical question of is the normal note taking technique (i.e. as usually practiced in school settings as an aid in passing exams), which involves a review period, better than attending without notes. The

other seeks to determine the influence on recall of note taking per se. For these reasons, the present author has chosen to examine the two types of studies in separate sections. Studies involving note taking with review are examined in the present section, while note taking without review are examined in the second section. Each section is further divided according to the method used to present the material, i.e. orally or in print.

Listening. Studies involving material that was listened to offer fairly consistent support for the efficacy of note taking as a study aid when review of the notes is allowed. A series of experiments was reported by Crawford (1925b) in which four (numbers 4-6) sought to determine if the recall of the points made in a spoken lecture was higher (a) if the lecture was listened to without taking notes, or (b) if notes were taken and later reviewed. The subjects, as in many note taking studies, were college students. Various time periods were used between presentation and recall testing.

In all four experiments (Crawford, 1925b, experiments numbered 1-4) recall was tested by essay questions, but in two (numbers 5 and 6) recall was also tested by objective tests. The results of all four essay tests and the objective test of experiment number 5 favoured the superiority of note taking. Only the objective test of

number 6 favoured the listening group. The major difference between experiments 5 and 6 were,: the material studied in number 5 was a classroom lecture, in number 6 it was a classroom discussion; number 5 provided a 10 minute review period immediately before taking the test while no such period was used in number 6, though subjects had their notes in their possession for review at home; the order of testing was objective then essay in number 5, reversed in number 6; and the delay period between presentation and testing was less than a week in number 5, about 2 weeks in number 6.

DiVesta and Gray (1972, 1973), using college student subjects, reported three experiments which generally support the superiority of note taking plus review over listening to a lecture. The first of these experiments (DiVesta and Gray, 1972) found that those subjects taking notes recalled more ideas on a free recall test and scored higher on a multiple choice test than did those subjects permitted only to listen. Review of the material enhanced recall, at least on the free recall test, as did the taking of a fill-in-the blank test on the material studied before actual recall testing (the fill-in test may also constitute a review period). The other two experiments (DiVesta and Gray, 1973) compared the recall of college student subjects who took and reviewed notes with subjects

who listened to the lecture without taking notes and reviewed mentally. Free recall immediately after the review period and multiple choice test scores 1 week later were higher for the note takers. No difference between groups was found for scores on multiple-choice tests administered immediately after the free recall test, but this result may be due to the difference in reliability of the two multiple-choice tests used (the immediate test had only 30 items while the 1 week delay test had 115 items).

Perhaps the best evidence to date supporting note taking plus review over only listening (or even listening plus review) comes from a study by Fisher and Harris (1973). Using college students as subjects, this study compared the immediate and delayed (3 weeks) recall of a spoken lecture produced by five study techniques: subjects (a) took notes and reviewed their own notes, (b) took no notes and reviewed the lecturer's notes, (c) took notes and reviewed the lecturer's notes, (d) took notes and mentally reviewed, and (e) took no notes and mentally reviewed. Of special interest here is the finding that the note takers who reviewed their own notes recalled more than did any of the other four groups on both free recall and objective tests administered immediately after a review period. No significant difference was found on

the delayed objective test, but a 38% subject drop out rate may have precluded a fair analysis of the delayed test results. Also, no review period was provided before the delayed test. This study also raises the interesting question of the value of reviewing one's own notes versus reviewing notes supplied by the lecturer. While taking notes and reviewing one's own notes produced the highest recall (the finding with the most practical importance, as it most closely resembles note taking as practiced in "natural" settings), listening but reviewing the lecturer's notes produced better recall than note taking and reviewing the lecturer's notes. The authors speculate that the substitution of the lecturer's notes for the subject's own notes may have interfered in some way with normal memory processes.

Thus far, the weight of the evidence supports the conclusion that note taking plus review produces better recall of a spoken lecture than is produced by listening to the lecture. Those experiments reviewed so far that provide contradictory evidence appear to have methodological problems which precludes fair evaluation of the contradictory findings. The only remaining negative findings appearing in Table 18 were reported in a study by Eisner and Rohde (1959). This study sought to determine if note taking during a lecture produces better than note taking

during a lecture produces better recall than note taking after the lecture. Both groups were allowed to review these notes during a 15 minute period, though the "after-lecture" note takers also had to write their notes in this period. No difference between the two groups were found either on objective nor essay tests given 2 days after lecture nor on objective test administered 3 weeks later. However, these results may not be applicable here as both groups took and reviewed notes and there was no group which listened without taking notes either before or after the lecture.

Reading. Regrettably, no studies are known to the present author which have compared the recall produced by note taking with review with that of reading without taking notes.

Conclusions. With respect to a spoken lecture, note taking with an opportunity to review the notes (at least with respect to the practical question of reviewing ones own notes) before testing appears to produce better recall of the points made in the lecture than does listening to the lecture without taking notes. However, before this conclusion can be extended to include all meaningful verbal material usually found in the classroom, studies which utilize printed material as the to-be-learning material (i.e. reading) are needed.

Note Taking without Review

As they closely approximate the "real-life" educational environment (in which notes are generally taken with the idea of reviewing them before exams), studies of the effect on test scores of notes taken with review have important educational implications. However, as already mentioned, these studies also have characteristic problems (e.g. equating study time and the availability of material to be reviewed). Owing to these problems, the contributions of note taking per se can not be evaluated by investigations involving a review period, especially comparisons between reviewing notes and reviewing mentally. Fisher and Harris (1973) attempted to evaluate the effect of note taking per se by allowing note takers and non-note takers to review a set of notes prepared by the lecturer. It was found that the non-note takers recalled more under these conditions. However, the substitution of the lecturer's notes for the subject's own notes may have interfered, in some way, with the note takers' studying. A better way to determine the affect of note taking per se is to compare two groups, one which studies by attending to the material and one which takes notes while attending but does not get to review the notes. The following two subsections review studies which have incorporated this idea in their design.

Listening. As can be seen from Table 18, with

respect to listening, those studies reporting evidence supporting note taking (Crawford, 1925b; Fisher and Harris, 1973) generally used free recall tests of recall while those reporting evidence not supporting note taking generally used cued recall tests (Crawford, 1925b; Fisher and Harris, 1973; McClendon, 1958). Crawford (1925b) reported three experiments (numbers 1-3) in which recall was tested immediately after subjects listened to a lecture during which half the subjects were told to take notes and half were told they could not take notes. In all three experiments recall was tested by essay question and in each case, note taking produced superior recall. However, in two of these experiments (numbers 2 and 3), objective tests were also given immediately after the essay questions. On each of these tests recall was slightly better for the non-note takers.

McClendon (1958) also tested recall of a spoken lecture by objective tests. Listening without taking notes was contrasted with three different styles of listening and note taking: (a) recording "only the speaker's main points"; (b) recording "as many details as possible"; and (c) the subject's "customary manner". No opportunity for review was provided, and the notes were collected after the lecture. Recall was tested immediately after the lecture and again 5 weeks later. No significant differences

in recall were found among the four conditions.

Data from two of the groups used by Fisher and Harris (1973) are also applicable here. In these two groups subjects either listened without taking notes, or they took notes while listening. Review of notes was not allowed, but both groups were instructed to "mentally review" the lecture (this may avoid the problems of comparing reviewing of notes with reviewing mentally). There was no difference between the two groups on an objective test administered 3 weeks later, but on both free recall and objective tests administered immediately after the review period note takers recalled more than did non-note takers. The results of the immediate objective test are in contradiction to the pattern apparent in Table 18. This may be due to the "mental review" period, but it is not clear why this should be the case.

The only other evidence contradictory to the pattern evident in Table 18 involves testing by free recall. Noall (1962) compared the recall of three groups of college student subjects: (a) listening to material; (b) note taking while listening to the material; and (c) reading the same material (no reading plus note taking group was used). The reading group had superior recall on tests administered both immediately after presenting the material and 1 week later. There was no difference between the

listening and the note taking while listening groups. However, Noall describes the test he used as "unaided recall with blank outlines", but no mention is made of the amount of information conveyed by these "blank outlines". It is possible that the outlines provided as many cues as do objective tests and may be closer to cued recall than free recall. In addition, Noall's learning material was short (4 minutes) compared to most other studies involving listening and note taking (e.g. McClendon, 1958, used 13 and 14 minute lectures and Fisher and Harris, 1973, used a 40 minute lecture).

It appears, then, that the effect of note taking per se is dependent on the type of test used to determine recall, at least when the to-be-learned material is a spoken lecture. Free recall tests show better recall for note takers, while cued recall tests show either no difference or better recall for listeners.

Reading. In general, investigations in which the study material was read have found no difference between note taking while reading and reading without note taking. Arnold (1942) compared the recall of four groups of college students: (a) repetitive reading without writing; (b) underlining and marginal notes; (c) outlining; and (d) precis writing. After a 30 to 40 minute study period, all written material was collected. No differences were found

among the four groups on objective tests administered both immediately following the study period and after a 5 week delay. Stordahl and Christensen (1956) compared the recall of four groups of air force trainees: (a) reading and outlining; (b) reading and underlining; (c) reading and summary writing; and (d) reading only. Recall was tested by multiple-choice exams immediately after studying and again 1 week later. No significant differences were found among the four groups on either tests. Noall (1962) compared the recall of three groups of grade 10 students: (a) reading and note taking; (b) reading only; and (c) listening only (no listening and note taking group was used). Recall was tested by multiple-choice exam immediately after studying and again 1 week later. No differences were found among the three groups on the immediate test, while on the delayed test, reading and reading plus note taking did not differ from each other but were both superior to listening. Todd and Kessler (1971) compared three groups of college students: (a) reading only; (b) reading and underlining; and (c) reading and note taking. No differences were found among the three groups on a free recall test administered immediately after studying. Schultz and DiVesta (1972) compared note taking while reading and reading only, using college students as subjects. Again, no differences

due to note taking conditions were found on a free recall test presented immediately after the study period.

The only evidence contradicting this trend was reported by Dynes (1932). Dynes compared two groups of high school students. One group was instructed to read and reread the material while the other was instructed to read rapidly, then underline important information and make notes, then review the underlinings and notes, then write a brief summary and recall what was read. Both groups studied for 30 minutes. Multiple-choice tests were administered before studying, immediately after and 3 weeks afterwards. Subjects were drawn from two high schools. In one school note takers scored higher before-after gains on both tests, but in the other school note takers scored higher on only the immedaite test. Dynes used a "critical ratio" test of significance but does not report the significant levels of his results. His data are therefore difficult to evaluate. The differences may be due to "complex" (as compared to "simple" note taking) study procedure used by the note taking subjects, as it seems to provide some review of notes.

The bulk of the evidence involving reading seems to be that note taking per se produces no different recall than does reading alone. However, in all the studies reviewed, the study period was equal for all groups within

a given experiemnt. It is possible to speculate that those who took notes did not get a chance to "rehearse" the material as much as did those subjects who read and reread the material. Although the Dynes' study also used equal study periods, the allowed time was sufficient to allow completion of the "complex" note taking technique. This technique may have in turn allowed sufficient review of the material to eliminate the rehersal advantage of the read and reread group.

Conclusions. The evidence available suggests that the effect of note taking per se on the recall of meaningful verbal material is dependent on whether the material to-be-learned is listened to or read, and also on whether recall is tested by free recall (e.g. essay) or cued recall (e.g. objective) tests. If the material is listened to, then note taking improves recall on free recall tests, but not on cued recall tests. If the material is read, note taking appears to have no effect on recall measured by either type of test.

It is not known why such relationships should exist (if indeed they do exist). One possibility, originally suggested by Crawford (1925b), is that cued recall tests measure the subject's ability to recognize specific points, whereas free recall tests measure the subject's ability to recall and organize a series of points. Note taking

presumably aides the latter, but not necessarily the former. Investigations exploring this idea may prove beneficial.

No study has yet attempted to investigate all three variables: (a) attending only versus note taking while attending; (b) listening versus reading; and (c) cued versus free recall. In order to more fully understand the relationships involved, it may prove beneficial to factorially combine all three of these variables in one study.

Other Comments

In addition to the traditional question of the effect of note taking on recall, it has been suggested that note taking may prove useful as a technique for studying the processes involved in learning meaningful prose (Howe, 1970; DiVesta and Gray, 1973). Just how useful a tool note taking can be in investigating these processes is not known at this time, but this may indeed be the direction future note taking studies will take. Several possible areas for investigation suggest themselves and this review will close by briefly mentioning three of them.

1. The notes taken by a subject can be characterized in various ways, and in turn, these characteristics may be related to recall. For example, Crawford (1925a) and Fisher and Harris (1973) both found a positive

correlation between the number of ideas from a spoken lecture recorded in the notes and the number recalled. In addition, Howe (1970) found that the probability of recalling an item that appeared in a subject's notes was higher than the probability of recalling an item not appearing in his notes. The number of ideas divided by the number of words contained in the subject's notes was also found by Howe (1970) to be positively correlated with recall, though Fisher and Harris (1973) did not confirm this finding.

The exact relationship between these characteristics (and others) and recall has yet to be determined.

2. The subject matter and structure of the material to-be-learned may also influence the effect of note taking on recall. Indeed, part of the variability in the results regarding the effect of note taking on recall might be due to the variability of the subject matter that was studied. Schultz and DiVesta (1972) found that the clustering strategy used in recall by the subject is influenced more by the organization of the passage when the learner studies by reading without taking notes than when note taking is permitted. However, DiVesta and Gray (1973) found that while both the thematic relatedness of the material and note taking both were related to recall, they did not interact with each other. McClendon (1958) also found

that subject matter did not influence his results, but all three of his lectures, while different, were on some aspect of human speech.

The relationship between note taking and such variables as material subject matter and structure remains to be determined.

3. Individual difference variables may also interact with note taking to affect recall. For example, Berliner (1971, reported in DiVesta and Gray, 1973) reported that when the subject's memory ability was low, attention was sometimes better than note taking as a learning strategy. On the other hand, when memory ability was high, he found that note taking was superior to paying attention. In addition, DiVesta and Gray (1973) found some evidence supporting the conclusion that subjects with good memory spans profit from taking notes while subjects with poor memory spans recalled more than subjects with good memory spans when neither took notes. On the other hand, neither general intelligence nor reading ability were found to influence the effect of note taking on recall (Stordahl and Christensen, 1956; Arnold, 1942). Nor was general intelligence found to be an important third factor in determining the correlation between notes and recall (Crawford, 1925a).

Other individual difference variables (e.g.

attention span, specific mental aptitudes) remain to be investigated, as does a determination of why memory span interacts with note taking.

APPENDIX B

Raw Data

Note taking: Grade 3

subject	sex	Note characteristics: relevancy	Note characteristics: irrelevancy	Note characteristics: words	Immediate recall: relevant facts	Immediate recall: nonrelevant facts	Delayed recall: relevant facts	Delayed recall: nonrelevant facts
1	m	2	4	49	2	0	0	0
2	m	7	2	51	3	0	2	0
3	m	5	3	62	4	0	2	1
4	m	8	0	53	8	0	1	1
5	m	10	1	62	5	0	2	0
6	f	0	13	75	0	0	1	1
7	f	5	4	62	5	0	2	0
8	f	1	5	46	0	0	0	0
9	f	8	4	84	10	0	2	1
10	f	11	5	88	8	3	3	2
11	f	6	0	50	4	2	0	2
12	f	9	4	66	7	0	5	2
13	m	0	2	11	4	0	3	1
14	m	1	3	38	6	1	0	0
15	f	0	0	20	6	0	1	0
16	f	5	0	28	3	0	0	0
17	f	0	4	46	6	0	1	2
18	f	1	0	35	8	0	1	1
19	f	3	0	18	1	0	3	0
20	f	5	0	31	1	0	0	2

Note.--Subjects 1-12 are from school A. Subjects 13-20 are from school B.

Note taking: Grade 5

		Note characteristics			Immediate recall		Delayed recall	
subject	sex	relevancy	irrelevancy	words	relevant facts	nonrelevant facts	relevant facts	nonrelefacts
1	m	8	6	89	8	0	5	0
2	m	14	2	99	13	0	8	4
3	m	20	9	57	10	2	13	0
4	m	7	3	73	4	0	0	4
5	m	21	10	99	9	1	7	3
6	m	10	6	103	8	0	1	0
7	f	10	4	85	10	2	12	6
8	f	16	2	100	11	0	9	0
9	f	12	7	98	7	6	2	2
10	f	4	4	40	5	2	4	0
11	f	11	6	116	11	1	5	3
12	f	8	6	99	9	2	6	3
13	m	15	6	123	16	8	13	8
14	m	9	1	55	12	0	3	1
15	m	18	9	118	11	6	3	4
16	m	4	5	53	13	1	3	0
17	m	8	1	74	13	1	4	1
18	f	14	9	156	8	1	1	2
19	f	20	7	85	12	0	7	6
20	f	7	5	80	8	1	0	2

Note.--Subjects 1-12 are from school A. Subjects 13-20 are from school B.

Note taking: Grade 7

		Note characteristics			Immediate recall		Delayed recall	
subject	sex	relevancy	irrelevancy	words	relevant facts	nonrelevant facts	relevant facts	nonrelevant facts
1	m	12	2	76	7	0	3	3
2	m	21	11	96	13	2	4	0
3	m	21	12	86	17	1	6	4
4	m	15	8	109	12	0	8	4
5	m	21	0	51	6	2	3	3
6	m	21	10	90	17	3	9	2
7	m	21	6	87	14	1	9	2
8	f	21	1	42	11	3	8	1
9	f	21	11	97	13	5	6	4
10	f	12	5	97	11	2	6	0
11	f	21	11	99	15	9	5	3
12	f	21	8	92	11	2	3	3
13	m	21	8	110	18	5	8	3
14	m	21	9	95	16	0	7	0
15	m	19	8	85	12	4	6	3
16	f	19	8	91	15	1	2	4
17	f	19	8	100	7	1	0	3
18	f	21	12	79	8	1	6	3
19	f	21	7	127	15	5	9	7
20	f	20	7	100	13	3	5	3

Note.--Subjects 1-12 are from school a. Subjects 13-20 are from school B.

Reading: Grade 3

subject	sex	Immediate recall		Delayed recall	
		relevant facts	nonrelevant facts	relevant facts	nonrelevant facts
1	m	5	0	0	0
2	m	5	0	0	1
3	m	4	0	2	3
4	m	2	0	1	1
5	m	5	0	7	2
6	m	0	0	0	0
7	m	1	0	1	0
8	f	3	0	2	0
9	f	0	0	0	0
10	f	9	0	4	1
11	f	8	1	2	3
12	f	6	0	1	2
13	m	5	0	1	2
14	m	3	0	0	1
15	m	0	0	0	0
16	f	0	0	3	0
17	f	5	0	1	0
18	f	3	0	0	0
19	f	6	0	4	1
20	f	8	1	1	4

Note.--Subjects 1-12 are from school A. Subjects 13-20 are from school B.

Reading: Grade 5

subject	sex	Immediate recall		Delayed recall	
		relevant facts	nonrelevant facts	relevant facts	nonrelevant facts
1	m	6	0	3	1
2	m	9	5	2	1
3	m	5	0	0	0
4	m	6	2	0	1
5	m	6	0	7	2
6	f	11	6	7	2
7	f	16	1	9	3
8	f	11	0	0	2
9	f	8	1	0	1
10	f	4	0	1	1
11	f	8	0	2	3
12	f	5	1	0	0
13	m	3	0	0	1
14	m	1	0	3	3
15	m	6	0	4	1
16	m	5	0	4	0
17	f	9	0	2	2
18	f	8	0	0	2
19	f	4	4	2	4
20	f	8	2	6	2

Note.--Subjects 1-12 are from school A. Subjects 13-20 are from school B.

Reading: Grade 7

subject	sex	Immediate recall		Delayed recall	
		relevant facts	nonrelevant facts	relevant facts	nonrelevant facts
1	m	21	4	4	3
2	m	21	6	10	6
3	m	17	4	7	0
4	m	18	0	4	2
5	m	19	7	11	5
6	m	15	0	8	4
7	m	16	1	4	0
8	m	11	0	2	2
9	m	11	6	8	5
10	f	16	5	9	4
11	f	3	0	5	2
12	f	18	5	7	0
13	m	20	2	15	5
14	m	21	4	14	5
15	m	20	1	8	1
16	f	15	1	6	2
17	f	18	4	9	3
18	f	11	1	4	4
19	f	21	5	7	3
20	f	17	3	6	2

Note.--Subjects 1-12 are from school A. Subjects 13-20 are from school B.

APPENDIX C

Vita Auctoris

VITA AUCTORIS

Paul Joseph John Tumolo was born on October 18, 1946 in Milford, Massachusetts, U.S.A. He attended public schools in Milford, receiving his high school diploma in June, 1964. In May, 1969 he was graduated from the University of Massachusetts, Amherst, with the degree of Bachelor of Science, majoring in mathematics. In September, 1972 he began his graduate studies in psychology at the University of Windsor.