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Deriving the Meaning of Unknown Words From Multiple Contexts

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Students from 11 to 12 years old were invited to derive the meaning of five unknown words, each embedded in three contexts. We focused on the students' proficiency in three activities: decontextualization of the target word meanings from the contexts (decontextualization), testing initial ideas about the word meanings with subsequent contexts (cumulative testing), and formulating dictionary-like definitions (defining). We compared eight students of high and eight students of low verbal ability. The students were led individually through the process of deriving the meaning of the target words, while thinking aloud. The study showed that even young students of low verbal ability are capable of performing meaning-derivation activities that are in general ascribed to mature students of high verbal ability.

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Graves (1986) estimated that students acquire on average between 1,000 and 5,000 words from context throughout the course of a school year. His findings also indicated that the vocabularies of students of high and low verbal ability grow at different rates, with the result that differences in vocabulary growth increase over the years. Several plausible explanations have been given for differences in acquisition rate. First, students of high verbal ability tend to become good readers, who encounter larger amounts of texts and more new words than their classmates who are experiencing reading difficulties. For this reason, they have more chances to increase their vocabulary (Stanovich, 1986). Second, students of high verbal ability tend to build up a large vocabulary, with the result that the number of unknown words in text passages is often lower for these students than for classmates of low verbal ability. Therefore, the actual starting point for deriving the meaning of unknown words is more favorable for children of high verbal ability than for their counterparts of lower verbal ability (Anderson & Freebody, 1981; Carver, 1994). Third, students of high verbal ability are more active in deriving the meaning of unknown words they encounter. They make better use of multiple sources of information (Goerss, Beck, & McKeown, 1999; Miller & Gildea, 1987), construct more abstract, paradigmatic representations of words in addition to context-bound representations (Bloom & Gleitman, 1999), and are more proficient in basic processes, such as recognizing symbols and words (Hunt, Lunneborg, & Lewis, 1975). In sum, being high verbal influences vocabulary growth in various ways. The term vocabulary growth refers, in this article, to changes in vocabulary knowledge due to incidental and intentional learning. These changes do not only concern quantitative aspects of vocabulary knowledge, such as the number of words which are familiar, but qualitative aspects also; examples of the latter are completeness of the knowledge of word meaning and the automaticity of retrieval of relevant aspects of meaning (e.g., Merrill, Sperber, & McCauley, 1981).

The intrinsic interdependency between students' reading behavior, already available word knowledge, and word-derivation

activities on the one hand and vocabulary growth on the other hand makes it difficult to investigate how vocabulary growth takes place. For instance, it is difficult to estimate to what extent "picking up" new words from context contributed to the vocabulary growth in a particular period in a student's life and to what extent instruction in meaning-derivation strategies enhanced that contribution. Fortunately, many research questions are tackled from the perspectives of practitioners as well as theorists. Much can be learned from practice-driven, ecologically valid studies into vocabulary growth during free reading and into the effects of instruction programs directed at improving students' skills in deriving word meanings. Studies that are firmly embedded in educational practice help draw the whole picture, the interplay of all relevant factors. At the same time, it is worthwhile to perform theory-driven investigations, which attempt to describe focal parts of the whole picture, such as the relationship between verbal ability and specific meaning-derivation skills. The present research took the theoretical perspective. We focused on the relationship between verbal ability and three meaning-derivation activities, i.e., "decontextualization," "cumulative testing," and "defining." In the next section, we explain what these three activities have in common and why they are focal in our study. In the sections that follow, we describe the experiment, the results, and the conclusions.

Word Meaning Derivation Activities

Deriving the meaning of unknown words from context occurs during the learning of the mother tongue and plays an important role in the learning of foreign languages as well (Huckin, Haynes, & Coady, 1993). Because our study concerns derivation of Dutch words by Dutch students, we focus on word derivation in the mother tongue. With this restriction, literature on the strategies used by students and advocated by teachers or researchers is still rich.

Strategies are, in general, defined as purposeful and situated (context-related) sequences of (mental) activities. Which strategies

are adopted for vocabulary learning depends on interactions among four factors: the text (e.g., number of unknown words in the text), the reader (e.g., interest in vocabulary knowledge in general or in specific words occurring in the text), the task (e.g., text comprehension or word learning), and the context (e.g., language or science class). In general, mature readers and readers of high verbal ability use more advanced strategies than younger readers and readers of low verbal ability. Many college students, for instance, have learned to explore the meaning of unfamiliar words by searching for the differences and similarities between these words and other unfamiliar or partly familiar words that occur in the same text and belong to the same category (e.g., <connotation> and <denotation>). This helps them to study the words intensively and to build a coherent network of word meanings (Flippo & Caverly, 2000). Beck, Perfetti, and McKeown (1982) advocated a similar strategy for younger students. Because younger students are not yet familiar with the strategy of comparing word meanings, instructors grouped target words beforehand and called similarities and differences to the students' attention.

The present study concerns the word-derivation activities of two groups of students from 11 to 12 years old, differing in verbal ability. We did not investigate the strategies of the students, however, nor their reasons to prefer one strategy above another. Rather than leaving students free to adopt a strategy, we arranged conditions wherein all students performed the same sequence of activities. This enabled us to research differences and similarities between students of high and low verbal ability who performed the same activities. Our interest in the chosen activities was raised when we reviewed literature on the cognitive processes involved in vocabulary learning. First, we found that students' strategies were mainly composed of three types of activities, occurring in various sequences and combinations. Second, we found that one type of activity was only described in studies on word derivation by mature students of high verbal ability, whereas these activities seemed to be absent in the strategies of younger students of low verbal ability.

We discerned the following three activity types (see Table 1 for an overview). The first type is *text oriented*; it occurs when a person is mainly concerned with understanding the whole text passage around the unknown word and only deals with the word's meaning to keep the flow of comprehension going. The second type of activity is *word oriented*; it occurs when a person is mainly concerned with detecting the contextual meaning of the unknown word and deals with the context in order to find out what the word means here. The third type of activity is *vocabulary knowledge oriented*; it occurs when a person is mainly concerned with using the encounter with the unknown word as an opportunity to improve his or her vocabulary knowledge and deals with the new word in order to derive knowledge, which can be integrated into semantic memory. Our study focuses on activities that belong to the third type. To clarify the framework, we first discuss all three types by giving typical examples. The examples refer to the target word <dilemma> as presented in the three text passages given in Table 2.

Text-Oriented Activities

Two text-oriented activities are substitution and checking. A simple way to deal with an unfamiliar word in context is to substitute for the word a familiar word or a couple of familiar words that fit in the sentence. For instance, the word <dilemma> in the first context in Table 2 might be replaced by the words "problem" or "difficult problem." Substituting of unknown words with familiar words fosters continuity of the reading process and minimizes the disturbance caused by unknown words in texts (see, e.g., Harmon, 1999). That is why we call the activity text-oriented. When a text is rich or redundant, a student might even skip unknown words altogether, without experiencing any loss of understanding. Skipping the word <dilemma> in context 1 leaves an unobtrusive gap and hampers understanding only marginally. In addition to substituting or skipping, students often check the plausibility of the reached understanding with their experiential knowledge (Stahl, Jacobson, Davis, & Davis, 1989). For instance,

Table 1

Activities involved in deriving the meaning of unknown words from context

Orientation	Activities
Text orientation	substitution with familiar word(s)
	checking with experiential knowledge
Word orientation	using contextual clues
(shifting from text to word)	morphological analysis
	rehearsal
Vocabulary knowledge orientation	decontextualization
(shifting from contextual word	cumulative testing
meaning to paradigmatic word	formulating dictionary-like definitions
meaning)	morphological analysis (2)
	rehearsal (2)

Table 2

The set of three contexts for <dilemma>

Context 1.	I don't know what to do. My friend has invited me to go on holidays with her and her family. During the same period, however, my sister is getting married. If I go with my friend, I will miss the wedding, but if I stay at home to attend the wedding, I cannot go on holidays with my friend. It is a real *dilemma*.
Context 2.	Yesterday in the kitchen it was a real *dilemma* for our dog. There were chips on the table and a big piece of sausage on the kitchen unit. He was pacing to and fro between the two and did not know what to start with. He would miss out on both chips and sausage if his owner came in.
Context 3.	Mary: "What shall I do? I am asked to play with the first team of my club tomorrow, but I would also like to watch the match Ajax-Heracles on television . . ." Simone: "I really don't think that's a *dilemma*. Ajax is going to win for sure, and the match is not going to be interesting. I think your choice is easy to make."

a student who substituted "problem" for the target word <dilemma> may take his time to check by reasoning as follows: "Yes, 'problem' fits the situation. It is indeed problematic when one has to choose between a wedding and an invitation to go on holidays with a friend."

Although text-oriented activities are primarily meant to reach understanding of the text at hand, we must assume that they also increase students' vocabulary knowledge incidentally. In the long run, students acquire knowledge about the domain of meaning of words and of the sort of texts in which they occur, especially when the same words are encountered repeatedly.

Word-Oriented Activities

In educational practice, word-oriented activities are widely used to speed up progress in learning new words. Advocated word-oriented activities are use of contextual clues (also called cues), morphological analysis of words, and rehearsal.

A precondition for using word-oriented strategies during reading or studying is that the student notice unknown words and make a shift from a text-oriented approach to a word-oriented approach. Noticing and making the shift should not be conceived of as natural activities for students who encounter unknown words. For instance, students who read the word <dilemma> in the first context of Table 2 may feel no need at all to pay special attention to the word. Once they have understood that the person in the story "has a problem" or "must make a difficult choice," they may find it quite appropriate to just pass on to the next step of the ongoing reading or studying task. It depends on the person's task and interest in words and word meanings whether he or she decides to halt and to derive information about the word's meaning from contextual clues or from other sources of information, such as the word's morphology.

Use of contextual clues is much researched in the domain of vocabulary learning (e.g., Beck & McKeown, 1991; Sternberg, 1987). Once students start looking for contextual clues about the meaning of <dilemma> in context 1 (see Table 2), various types of

clues are used, such as local clues and more distant clues. A local clue in context 1 is that the person in the story is "going to miss either a wedding or a chance to go on holidays with her friend"; a more distant clue is that the person in the story says that "she doesn't know what to do." A student who has located both clues might try to do justice to both, by reasoning as follows: "I might say that <dilemma> means 'problem,' because she doesn't know what to do, but I also want to take into account that she has to choose. Thus, I think that a dilemma is a special type of problem which has to do with making a choice." Activities involved in using contextual clues have been the focus of many programs aimed at improving students' strategies to enhance their word knowledge. Meta-analytic studies (Fukkink & de Glopper, 1998; Kuhn & Stahl, 1998) showed that such programs are, in general, moderately successful.

Morphological analysis of words is an activity that students engage in when they notice familiar elements in the form or features of unknown words (Anglin, 1993). In the case of the word <dilemma>, a student might, for instance, notice the prefix "di" which often means "two" and connect it to the "two things" that the person in the text wishes to do. In that case, the student could elaborate on the original idea that <dilemma> refers to "the problem that has to do with making a choice." The reasoning might be as follows: "di means two, so di-lemma probably refers to the special sort of problem that occurs when a person has two contradictory wishes."

Rehearsal of derived meanings is a third word-oriented activity. It is often advocated during periods in which students encounter large numbers of new words (Mondria, 1996). In educational practice, rehearsal is stimulated by instructing students to make notes of recently encountered words and word meanings in a personal vocabulary booklet.

Unknown words that occur in context and are singled out for closer inspection become familiar and linked to domains of meaning (e.g., Goerss, Beck, & McKeown, 1999). Encountering words in

multiple contexts also fosters acquaintance with differing meanings in specific contexts (Nagy, 1988).

Vocabulary-Knowledge-Oriented Activities

Both text-oriented and word-oriented activities contribute to students' vocabulary knowledge, but are not labeled "vocabulary-knowledge-oriented" in Table 1. This term has been kept in reserve for activities that are specifically related to building paradigmatic word knowledge. Word knowledge is called paradigmatic when words (lexical items) not only are related to the contexts in which they are used and to experientially based concepts, but become organized within domains of related words (Bloom & Gleitman, 1999; Nelson, 1983). For instance, the representation of the word <mother> in relation to other words for family relations, such as father, aunt, uncle, and so on, is called paradigmatic. This representation occurs at a later developmental stage than representation of the word <mother> in relation to a domain of meaning (such as the domains of "being near" and "taking care") and experiential concepts such as "warmth." Paradigmatic representations help build conceptual networks and vocabulary knowledge that is well structured, i.e., effective, coherent, and parsimonious (Anderson & Nagy, 1992; Graves, 1987). Three activities that facilitate shifting from a word-oriented approach to a vocabulary-knowledge-oriented approach are decontextualization, cumulative testing, and defining. We shall discuss these activities in some detail, because they are focal in the present study.

Decontextualization. When students encounter an unfamiliar word such as <dilemma>, they might ask themselves, "What is the meaning of the word <dilemma> in this passage?" We call this question word-oriented. However, they may also ask themselves, "How is the meaning of the word <dilemma> related to the meaning of other words that I know for various kinds of problems and choices?" We call this question vocabulary-knowledge-oriented. To answer the question, students must decontextualize

the meaning of <dilemma>; i.e., they must formulate the aspects of meaning in a formal, "conventional" way rather than in terms of the context in which they happened to encounter the word. The term *conventional* was introduced by Werner and Kaplan (1952) to refer to elements of meaning that are shared by people, whereas the term *idiosyncratic* was used to refer to elements of meaning that reflect the specific contexts in which individuals encountered the words. In our research, we do not use the terms conventional and idiosyncratic but rather the words *decontextualized* and *contextualized* to refer to essentially the same difference between paradigmatic word meanings and contextual word meanings (van Daalen-Kapteijns & Elshout-Mohr, 1981).

Decontextualization is a matter of degree. In the first context in which the word <dilemma> occurs (see Table 2), the word <dilemma> summarizes the position of the person who has to make the choice between attending a wedding and going on holidays with her friend. A meaning of the word <dilemma> that is not at all decontextualized is exhibited in the utterance, "Dilemma means that she doesn't know whether to attend the wedding or to go on holidays with her friend." Students who present such a meaning attach a "sentence core concept" to the unknown word (Goerss, Beck, & McKeown, 1999). A much more decontextualized meaning of the word <dilemma> is expressed in the utterance, "A dilemma is a difficult choice between two things." Whereas the meaning of the entire passage is absorbed in a contextualized meaning, the decontextualized meaning is restricted to elements of meaning, which link the unknown word to familiar words. By decontextualization, students relate the unknown word <dilemma> in a formal way to other lexical units, in this case the lexical unit choice. They identify (or rather hypothesize) two additional elements of meaning, namely that the choice is difficult and that it involves two alternatives. The word choice doesn't specify the degree of difficulty or the number of choices, whereas the word <dilemma> is assumed to be more specific. Earlier we mentioned the strategy to group unknown words in order to study the meaning intensively (Beck, Perfetti, & McKeown, 1982; Flippo & Caverly,

2000). Grouping probably elicits searching for shared meaning elements, thereby facilitating decontextualization.

Decontextualization activities result in representation of the word meaning in the students' semantic memory as part of the already available vocabulary knowledge. In the given example we expect that students link <dilemma> to the lexical unit "choice" and other units in the semantic network (Anderson & Nagy, 1992). For instance, the idea that <dilemma> means "a difficult choice between two things" facilitates relating <dilemma> to words that refer to choices which are easy to make, such as the word "preference."

Cumulative testing. Cumulative testing can be seen as a sophisticated form of checking. Deriving a word's meaning from just one context is always a hazardous enterprise and may lead to incorrect, partially correct, and incomplete ideas about the meaning of the word, even when initial ideas are checked with the student's own experiences. Cumulative testing consists of testing the evidence and counterevidence for derived elements of meaning in multiple contexts. If these contexts are not available or if they do not provide the necessary information, a final decision must be postponed.

In the given example of the word <dilemma>, a student could reason as follows: "I think that <dilemma> means that there is a problem and that the problem is difficult. I further suppose that the word <dilemma> is used when the problem has to do with making a choice between two options; . . . or perhaps any number of options." The student might keep in mind the provisional status of her ideas, until she had a chance to test them in other text passages, such as contexts 2 and 3 in Table 2. Cumulative testing involves testing original ideas in the contexts that follow, but it involves generating additional ideas as well. This is expressed in the word "cumulative." An example of a new idea that a student might pick up from reading contexts 2 and 3 in Table 2 is that <dilemma> is only used in situations in which a person has to choose between two or more attractive options, and that there might be another (unknown) word that refers to difficult choices between repelling options. Accordingly, cumulative testing is an

ongoing process of attaching provisional aspects of meaning to a word, of looking for evidence and counterevidence for these aspects, and of searching for refinement of the word meaning. The activity leads to effective use of information contained in multiple contexts about the meaning of unknown or partly familiar words (van Daalen-Kapteijns & Elshout-Mohr, 1981). Although there is little, if any, research on the occurrence of this activity in educational settings and free reading, we assume that cumulative testing is indispensable for the construction of well-structured vocabulary knowledge.

Defining. A third type of vocabulary-knowledge-oriented activity is constructing dictionary-like definitions (defining, for short). When an unknown word is repeatedly encountered in context, a reader may experience the need to know the formal definition. The word can be looked up in a dictionary, but a reader may also try to articulate a dictionary-like definition of his or her own. For instance, after normal reading of the three contexts in Table 2, a student might say to herself: "I think that I know what <dilemma> means, but can I articulate it? Can I give a dictionary-like definition?" Expert students might come up with excellent definitions, such as "a dilemma is a difficult choice between equally attractive options" or "a dilemma is a problem related to having to choose between equally attractive options." Less schooled students or students of lower verbal ability might stick to a more simple definition, such as "a dilemma is a problem," or to a still partly contextualized definition-like statement, such as "a dilemma is a problem, like when you have to choose between attending a wedding or going on holidays."

We are aware that several researchers have argued that the knowledge necessary to produce definitions is not actually needed in order to understand or use words correctly in context (Fodor, Garrett, Walter, & Parkes, 1980; Kuhn & Stahl, 1998). Although we agree with this, we also assume that a student could add quality to word knowledge by complementing contextual knowledge of a word meaning by paradigmatic knowledge, which relates the word's meaning to the meaning of other lexical units. Because

this is precisely the effect of defining, we consider defining a component of word-meaning-derivation strategies.

Morphological analysis (2) and rehearsal (2). Earlier, we categorized morphological analysis as being word-oriented, but it can also be used in a vocabulary-knowledge-oriented way. A student can search intentionally for word-components, such as the prefix "di" in <dilemma>, that are shared by different words. Used in this manner, this activity helps constructing and organizing the semantic network, i.e., the internal representation of vocabulary knowledge. In the same vein, rehearsal can be used in a word-oriented but also in a vocabulary-knowledge-oriented way. Rehearsal is vocabulary-knowledge-oriented when the student wants to repeat the meaning of a word to distinguish it from a related word meaning. The student might, for instance, say: "So an altruist is a person who is devoted to others rather than to himself, like an egotist is." Repetition of the distinctive aspects of meaning is likely to strengthen the relevant connections in the semantic network.

The Focus of Our Experiment

In the experiment, which is presented in the next section, we focused on the first three of the five vocabulary-knowledge-oriented activities: decontextualization, cumulative testing, and defining. Our aim was to fill the knowledge gap as to the capacities of younger students and students of low verbal ability to perform these activities. Also, we wanted to know more about how students can be stimulated to make a deliberate shift toward vocabulary-knowledge-oriented activities. Van Daalen-Kapteijns, Schouten-van Parreren, & de Glopper (1997) attempted to teach young students (from 11 to 12 years old) to switch from text-oriented to word-oriented derivation activities and from word-oriented to vocabulary-knowledge-oriented derivation activities. This attempt was but partly successful. The post-test revealed that most students still preferred text-oriented substitution-like activities. Trained students did not differ from untrained students in scores for vocabulary-knowledge-oriented activities, although their oral

reports reflected that the instruction had resulted in some emerging insights (see also van Daalen-Kapteijns, de Glopper, & Schouten-van Parreren, 1997). The present study is designed to identify vocabulary-knowledge-oriented activities that young students are capable of, under favorable circumstances and with proper help.

Method

The subjects in our experiment were students 11 and 12 years old. Half of them were chosen for their high verbal ability, the other half for their low verbal ability. The experimental task consisted of five target words presented in three text passages each. The students' task was to derive the correct meaning of each target word from the three passages. We used considerate contexts (Konopak, 1988), which provided ample information about the meaning of the target words, because we wanted to make sure that even students of low verbal ability would be capable of finding at least some clues in each context. The reason to offer three considerate contexts in succession was to set the stage for cumulative testing activities. The three contexts for <dilemma>in Table 2 were part of the experimental materials.

We did not expect the students to exhibit the focal activities of their own accord, neither in a natural setting, nor in the experimental setting. Therefore, one investigator guided all students through the task, individually. While doing so, the investigator gave no content help, nor hints about the meaning of the words. She just evoked attempts to perform the focal activities. The students worked while thinking aloud.

By designing the experiment in this way, we fulfilled the conditions that we thought necessary to make the three focal processes (decontextualization, cumulative testing and defining) come out clearly and separately in the performance of the students.

Participants

Sixteen Dutch sixth graders aged 11 and 12 years old participated in this study. Developmentally, students in this age group have made the transition to a more formal stage of cognitive functioning in the Piagetian sense (Inhelder, Sinclair, & Bovet, 1974). The students were selected on the basis of a test for Dutch vocabulary knowledge ("Woordentoets Nederlands"). The test consists of 60 four-choice items. Coefficient alpha was .90 in an earlier study with 402 sixth graders (de Glopper, van Daalen-Kapteijns, & Schouten-van Parreren, 1997). First the test was administered to 62 sixth graders. Then, from these 62, eight students of relatively low verbal ability (with a score of 0.75–1.75 standard deviations below the mean) and eight students of relatively high verbal ability (with a score of 0.75–1.75 standard deviations above the mean) were invited to participate in a think-aloud experiment. We will refer to the two groups as the lower and higher verbal ability group. The mean score for the former group was 24.25 (with a standard deviation of 4.03), whereas the mean score for the latter group was 52.13 (with a standard deviation of 4.85). It is important to note that the setup for the actual learning task was double blind: students were not aware that they represented a low or high verbal ability level and the researchers were not informed about the verbal ability level of individual students while they guided students through the task and analyzed protocols and products.

Learning Materials

Target words were ten existing Dutch words with complex meanings that are not (yet) known by most children 11 or 12 years old. To design considerate text passages, we first constructed a "target structure" for each word. A target structure is a schematic representation of the meaning of the target word. It contains the decontextualized (conventional) elements of meaning, which define the target word and link it to other words in semantic memory (van Daalen-Kapteijns & Elshout-Mohr, 1981). The target structures

of <dilemma> and <altruist> are presented in Tables 3a and 3b. A context for a target word is considerate when it contains clear clues about elements of the target structure. The target structures were also used in the scoring procedures.

Because students were to receive three contexts in succession for each target word, three pieces of text were written (in Dutch). Each piece described a situation in which the target word is fairly typically used and provided accessible clues about the meaning (i.e., the target structure) of the target word. For all target words, one of the three contexts represented a negative instance of typical usage of the word, and the other two contexts were positive instances. The length of the contexts varied from 30 to 60 words. The passages for the word <dilemma> are presented in Table 2; those for <altruist> are presented in Table 4. The passages are translated into English for this article.

Although ten target words were selected and ten sets of three contexts were prepared, only five sets were to form the items for the actual word-derivation task for each student. The five spare ones were used for students who happened to know the meaning of target words fully or partially.

Experimental Procedure

All 16 students of lower and higher verbal ability were asked to perform the same task, working individually with the first author. First they were introduced to the task. The investigator explained that she was interested in students' ways of figuring out the meaning of an unknown word from pieces of text. She made it clear that words had been selected that the students were not supposed to know. Then the investigator read aloud the instruction to derive the meaning of the unknown word from the contexts, including the instruction to think aloud. The students worked through a practice item, which acquainted them with the experimental task and the role of the investigator. The students completed five items in about 30 to 45 minutes.

Table 3a

Target structure of the word <dilemma>

	Superordinate concept	Aspect of meaning 1	Aspect of meaning 2
Option 1	Choice / to choose	Hard / problematic	Between two things
Option 2	Problem	Having to do with choice	Between two things

Table 3b

Target structure of the word <altruist>

	Superordinate concept	Aspect of meaning 1	Aspect of meaning 2
Option 1	Somebody	Willing to do things	For others
Option 2	A person	Who always/often does things	For others

Guiding students through the experimental task. The guiding procedure was as follows. After a short introduction, the first context for the first target word was presented. The student was asked to read it aloud and then try to find information about the meaning of the unknown word from the text, all the while working and thinking aloud. When the student was done, the investigator concluded this part of the item by asking: "What have you found out now about the meaning of <the target word>?" The investigator wrote down the answer to this question as result 1. Then the second context for the same target word was presented, following the same procedure, ending with result 2. Likewise, processing of the third context was concluded with result 3. After writing down result 3, the investigator said: "Now you have seen three texts with <the target word>; what do you think the word means?" The student was to answer this question while still thinking aloud. Then, the investigator concluded the item in a clear-cut way by asking: "And how do you think the dictionary would state the

Table 4

The set of three contexts for <altruist>

Context 1.	It is true indeed that my cousin is an *altruist*. Tired though she may be, she will always offer her seat to somebody else on the bus.
Context 2.	A boy in my class is very egoistic. Recently we were treated to candies. He immediately ran to the front of the class, because he was afraid he would get nothing. He will never share with others if, for instance, there are not enough cookies for everybody. He is absolutely no *altruist*.
Context 3.	Can you imagine going to a far and cold country to work for the Red Cross, if you have a good job and a nice home here? My doctor is an *altruist* like that. He would like to do something for the sick people over there, so he is going to work for two years in a small village somewhere up north.

meaning of <the target word>, or how would you put it in the dictionary?" Although we were aware that the students had but limited experience with dictionaries, we wanted to find out the extent of students' proficiency in defining. As the end result of the item, the investigator wrote down the dictionary-like definition.

The Data

The experimental task yielded two kinds of data: thinking-aloud protocols, transcribed from the tape-recorded experimental sessions, and data about derived meaning aspects and dictionary-like definitions which were written down by the investigator during the session. An overview is given in Table 5.

Two Research Questions

The first research question is: Do students in the high and low verbal group differ in a quantifiable way concerning three focal

Table 5

The data resulting from the learning task per item

	Think aloud protocols	Data written down by the experimenter
Context 1	Protocol part 1	Result 1
Context 2	Protocol part 2	Result 2
Context 3	Protocol part 3	Result 3
Definition task	Concluding protocol part	Definition: End result

vocabulary-knowledge-oriented activities? Three hypotheses were formulated:

1. Students in the high verbal ability group show more decontextualization than students in the low verbal ability group.

2. Students in the high verbal ability group show more cumulative testing than students in the low verbal ability group.

3. Students in the high verbal ability group provide better dictionary-like definitions than students in the low verbal ability group.

To test these hypotheses, the raw data had to be transformed into quantifiable dependent measures.

The second research question is: Do students in the high and low verbal group differ in the quality of their skills and emerging skills in the three vocabulary-knowledge-oriented activities? To characterize these skills, we analyzed the data qualitatively.

Dependent measures. To test the hypotheses, three dependent measures were used, two process measures and one product measure. A description is given below.

1. "Degree of decontextualization" is the degree to which the derivations made by the student have some distance from the situation as described in the context and show development in the direction of more conventional aspects of meaning.

2. The second measure, "degree of cumulative testing," is the degree to which the student takes a derivation from an earlier context along to the next context (from the first to the second or from the second to the third context). This becomes visible when the student tests whether a derivation he or she made earlier is consistent with the information in the current context.

3. The third measure concerns the definition for each target word, given by the students as the end product of their derivation activities. The "quality of the definition" for the particular word is established by comparing the definition with the meaning aspects represented in the target structure.

Scoring Procedures

The thinking-aloud protocols and the written data were prepared for scoring without any indication of the verbal ability level of the student concerned. The scoring was conducted by two judges who worked independently and were guided by a scoring manual for each dependent measure. Kappa was computed to establish inter-rater reliabilities. For the three dependent measures the values of kappa were .57, .67, and .71, respectively. The average of the scores given by the two judges per item constituted the final score. The actual scoring procedure is described below and illustrated by the data for <dilemma> provided by one of the students, whom we call Cynthia (see the Appendix).

Decontextualization. Degree of decontextualization was judged by results 1, 2, and 3, as written down by the investigator to conclude the processing of each separate context per target word. Each result was credited a decontextualization score of 0 (very context-bound), 1 (fairly context-bound), 2 (somewhat loosened from the context), or 3 (fairly context-free). Whether the word meaning was reached by substitution of a familiar word for the unknown word or by any other derivation activity was not taken

into consideration. Because the students processed three contexts for each of five target words, the score per item ranges from 0 to 9, with a maximum total score (summed over 5 items) of 45.

Example: Cynthia concludes from processing context 1 for <dilemma>: "that it is a problem." (See the Appendix, result 1.) This result is credited a score of 3. Another example of result 1 given by another student is "that he does not know what to do, the wedding or the holidays"; this result is context-bound and therefore credited a decontextualization score of zero.

Cumulative testing. For judging the degree of cumulative testing, the protocols and written data for the whole item were considered. Correctness and form of the derivations made by the students were not taken into consideration. The number of times that a derivation, made from an earlier context, was tested in a following context was established. Each tested derivation contributed two points to the score, and a new derivation made from the third context added one point, because this might have been tested if a fourth context had been available. Theoretically there is no fixed maximum to the cumulative testing score, but the highest score obtained for any target word was 9 (four tested derivations plus one new derivation from the third context), which means that for all practical purposes the maximum total score, summed over five items, was 45.

Example: The cumulative testing score for <dilemma> by Cynthia (see the Appendix) amounted to 4. This score resulted from the data in the following way. Cynthia orally derived two elements from the first context. The derivation "that it is a problem for something" was not explicitly tested during processing of context 2 and 3 and was therefore not rewarded. The second derivation was "you have to choose then." This was tested when the student, after having read context 2, said, "Yes again, he again has to make a choice." This tested derivation was credited with 2 points. Furthermore, the student derived "between the two" from context 2 and gave evidence of testing this element while working on context 3 by saying, "He again has to choose between two things." This added another two points to the score. (Actually the student hereby tested both the "choice" derivation and the

"between two things" derivation. Because the "choice" derivation had already been tested in context 2 and the student had been given credit for that, this did not add to the score at this point.) No further derivations were made from context 3, so the cumulative testing score for this item totaled 4.

Defining. The dictionary-like definition for each target word was judged by comparing the definition with the target structure for the word concerned (see Table 3a for the target structure of <dilemma>). Per target word, each aspect of meaning was credited a score of 2 (adequate), 1 (fairly adequate), or 0 (inadequate). The number of elements in each target structure was arbitrarily limited to three. However, if a student added one more correct element to the target structure, this element was credited also. The maximum score per item is 8, with a maximum total score, summed over five items, of 40.

Example: The definition of <dilemma> given by Cynthia (see the Appendix) is "that it has to be a choice." This definition is credited a score of 2.

The internal consistency of the three dependent measures, estimated per measure by computing coefficient alpha over five items, was .81, .89, and .67, respectively.

Results

The First Research Question

Predictions were that the higher verbal ability group would outperform the lower verbal group on measures 1 through 3. These predictions were tested by *t* test. Beforehand, homogeneity of variance was tested for the dependent variables by computing Cochran's *C*. The *p* values for the computed *C* values were .57, .17, and .21, respectively, indicating that the condition of homogeneity of variance was not violated.

Table 6 presents the means and standard deviations of the scores for the three dependent measures, as well as the *t* values

and the effect sizes. The latter are computed following Hedges' unbiased estimator (Hedges & Olkin, 1985, p. 80). The criterion for statistical significance was set to equal .01. All three *t* values in Table 6 reach significance. The effect-sizes are large (Cohen, 1988). The results indicate that the higher verbal ability group gained significantly higher scores on the three dependent measures than their classmates of lower verbal ability. In other words, students of higher verbal ability, as a group, performed the three focal meaning-derivation activities more often and with a better outcome than students of lower verbal ability as a group. These results were in line with the expectations.

The Second Research Question

The second question concerned the quality of the students' skills in decontextualization, cumulative testing, and formulating dictionary-like definitions. To answer this question, we first compared the mean scores of both groups (see Table 6) with the maximum scores for decontextualization, cumulative testing, and giving dictionary-like definitions (maximum scores were 45 for decontextualization, 45 for cumulative testing, and 40 for quality of definition). Students of the high verbal group reached 77, 67, and 53 percent of the maximum scores, and students of the low verbal group reached 45, 47, and 33 percent. These figures showed that the experimental task was quite a challenge for students from 11 to 12 years old. Even those who had been selected for being of high verbal ability performed less than perfectly. The definition task proved to be the most difficult task. On the other hand, one could say that the students performed quite satisfactorily. Even those students who had been selected for being of low verbal ability gathered a considerable number of credit points for each of the three focal activities. This warrants the conclusion that we actually succeeded in eliciting vocabulary-knowledge-oriented activities by offering favorable conditions and strict, individual guidance. We investigated decontextualization, cumulative testing, and defining activities in more detail.

Table 6

The effect of vocabulary test score on three dependent measures: t*-values and effect sizes for the comparison between the subgroup of higher verbal ability (HVA,* n = *8) and the subgroup of lower verbal ability (LVA,* n = *8)*

	HVA		LVA			
	M	*SD*	*M*	*SD*	*t*-value	Effect size[1]
Cumulative testing	30.00	5.76	21.00	7.21	2.76*	1.31
Decontextualization	34.50	6.61	20.13	11.53	3.06*	1.45
Quality of definition	21.38	3.89	13.00	6.41	3.16*	1.49

[1] Hedges unbiased estimator
*$p < .01$

Decontextualization. To identify decontextualization activities, we first looked at the word meanings that the students derived from the first context and counted the number of elements of meaning derived (see Scoring Procedures). Students of the high verbal group derived 2.43 elements of meaning on average from the first context, whereas the students of the low verbal group derived 1.25 elements of meaning on average from the same context. To illustrate the kind of reasoning used, which typically resulted in a large and a small number of elements, we present fragments of the think-aloud protocols of students whom we call Daphne, Remy, and Quentin. The students were working on the first text passage for the target word <altruist> (see Table 4).

Daphne (high verbal) tried to go beyond the contextual meaning of the target word by formulating its meaning in a more general, formal manner. Her main concern seemed to be to decontextualize separate aspects and to formulate them in a proper manner. Daphne reasoned as follows in reaction to context 1 for <altruist>:

D: "I think that that is somebody who always, . . . whatever is the matter, . . . simply does . . . does it for someone."

While the investigator is writing "somebody who always, . . . whatever is the matter," Daphne repeats the latter part of the sentence in a somewhat revised form.

D: ". . . who does what is being asked for someone."

The investigator writes this down, also.

Remy (low verbal) substituted for the target word a familiar word that fit the context. Remy reasoned as follows in reaction to context 1 for <altruist>:

R: ". . . eh, kind?"

Investigator: "I am not allowed to tell you whether it is right or wrong, so it's up to you."

R: "OK, gets up in the bus, for somebody; kind, I think."

Investigator writes down "kind."

Quentin (low verbal) seemed to be at a loss with the task. He produced a sentence-core concept, but hesitated about the appropriateness. Quentin reasoned as follows in reaction to context 1 for <altruist>:

Q: (saying nothing for about 20 seconds)

Investigator: "So what do you think that this passage tells you?"

Q: "What the meaning is of the word?"

Investigator: "Yes"

Q: "That tired though she may be, she will get up for somebody."

Investigator: "So, when I ask you what this passage tells you about the meaning of <altruist> what would you say?"

Q: "ehm, . . . (softly) I don't know . . ."

These fragments showed that the task in which Daphne was involved was different from the one that Remy put himself to, while Quentin exhibited a helplessness that the other students did not. Such observations do not, of course, explain why Daphne decontextualized the word's meaning from the context. However, the protocols did inform us about the kind of differences that could underlay differences in vocabulary growth (cf. Graves, 1986). In our mind, there is no doubt, for instance, that Daphne's approach

in the given example is more promising for building a large, well-organized vocabulary than the approaches Remy and Quentin exhibited. To substantiate this idea, we searched for signs of decontextualization in the students' handling of the second and third contexts for the target words. We found that most of our students used text- or word-oriented activities, but vocabulary-knowledge-oriented activities as well, and that they frequently switched from one approach to another. This was the case for students of high and low verbal ability alike. Switches among orientations are illustrated in the following fragments of the protocols of Daphne and Quentin. The students are now working on the second text passage for the target word <altruist> (see Table 4).

Daphne (high verbal) was engaged in grasping the meaning of <no altruist> in a context-bound manner. She reasoned as follows in reaction to context 2 for <altruist>:

D: (saying nothing for about 10 seconds)

Investigator: "Yes, try telling me what you are doing."

D: "Eh, that . . . eh that he is just, that he is just thinking only of himself."

Investigator: "So, what did you find out about the meaning of <altruist>?"

D: "That he is not an altruist, because he is always thinking only of himself, because he is afraid that he is not getting anything."

Investigator writes down this statement.

Quentin (low verbal). In comparison with his reaction to passage 1, Quentin was now quick in responding to passage 2. He decontextualized the meaning of the target word and referred to a general "you" instead of the "boy" or "he" that is described in the text. However, when he had to repeat what he found, he used the more context-bound word "he" again. Quentin reasoned as follows:

Investigator: "And what does this passage tell you about <altruist>?"

Q: "That altruist, that you do not only think of yourself, that you also think of others."

Investigator: "Shall I write that down? Please say it again."

Q : "That he does not only think of himself."

Investigator writes down this statement.

Evidently, the protocols add to the finding that the total number of decontextualization activities is higher in students of high verbal ability than in students of low verbal ability. They show that the students of high verbal ability do not always go beyond the contextual meaning of unknown or partially known words, and that the students of low verbal ability do not totally lack the capability to decontextualize.

Cumulative testing. To investigate cumulative testing activities, we kept track of the word meanings that individual students derived from successive contexts. The following fragments illustrate cumulative testing as found in the protocols.

Marc (high verbal). Marc formulated an element of meaning for the target word, which was then confirmed (rather than actively tested!) in the second context. In the third context, he added a new—still to be tested—element. Marc reasoned as follows in reaction to contexts 1, 2, and 3 for the word <altruist>:

Context 1.

M: "Well, someone who is rather kind to other people."

Investigator: "So, what did you find out about the meaning of <altruist>?"

M: "someone who is kind to other people."

Context 2.

M: "eh. . . ."

Investigator: "Can you tell me what you are doing, what you are thinking of?"

M: "Eh . . . , actually I am thinking the same thing again."

Investigator: "So, what did this passage tell you about the meaning of <altruist>?"

M: "Eh . . . , altruist is someone who is kind to other people."

Context 3.

M: ". . . Someone who takes care of other people?"

Investigator: "You are the one to decide. I just would like you to say what you found out about the meaning of <altruist>."

M. "Again, someone who is kind and takes care of other people."

Stephanie (low verbal) elaborated several ideas about the meaning of <altruist> while processing the first context. Because the elements of meaning were not fully decontextualized, cumulative testing was difficult. This is shown in Stephanie's reasoning in reaction to contexts 1 and 3 for <altruist>:

Context 1.

S: "It means, I think, that you, that you—even when you are tired—that you will offer your seat to someone else, that that does not change, that you offer your seat, that you . . . what is the proper way to say it . . . that you just, when someone asks you to . . . even when you are tired . . . that you just do it."

Investigator: "So, when I ask you what this passage tells you about the meaning of <altruist>, what would you say?"

S: "Eh, yes, that you just, . . . that you just do something for somebody else . . . if you are asked to do so, even when you are tired or when you do not feel like it, that you just do it."

Context 3.

S: "Yes, I still think that he . . . just, because he wishes for somebody else to fare well, that he does something for somebody else. Not only because of what he does for himself, for he has a good position and a nice home, but he wants to go to the other country to help the people over there."

Investigator: "So, when I ask you what this passage tells you about the meaning of <altruist>, what would you say?"

S: "That you just, that you . . . for somebody else, that you give up about everything, . . . that you give up your very home because you want to help those people in that poor country."

Like decontextualization, cumulative testing proved to be a matter of degree. None of the students in our experimental group of young students stated clear-cut hypotheses or tested ideas

systematically in successive text passages. Still, all of our students seemed to be aware that they needed to preserve some unity in the meaning of the target word in the three successive passages. This was shown, for instance, in their choice of wording. Once a student had chosen a word or a couple of words to characterize the <altruist> in the first text passage, he or she tended to stick to the chosen phraseology. While some students took along words such as "kind" (like Marc did) or "friendly," others felt obliged to stick—at least for some time—to words like "polite" or "respectful." Probably the repetitive use of the word "just" and the phrase "for somebody else" in Stephanie's protocol must be interpreted in the same vein. We conclude that the protocols indicate that even students of low verbal ability strive for overlap between the contextual word meanings or core-sentence concepts, which they attach to a word that they encounter in multiple contexts. We view this striving as a precursor of cumulative testing, because the students are aware that they are not free to attach any meaning to a target word without caring about the word's meaning in prior contexts.

Defining. When the students had finished working on the third context, they had to collect and summarize what they found out in order to conclude with a dictionary-like definition. Although the students had limited experience with dictionaries, all of them showed awareness of one or two of the following ideas: contextual details should be deleted, conventional or formal terms should be preferred, and part of speech should correspond to the target word. A few defining activities are shown in the following two protocol fragments.

Marc (high verbal) transformed his original description of the meaning of <altruist> to a more formal definition.

Investigator: "What is your idea about the meaning of <altruist>?"

M: "Somebody who is kind for other people and who takes good care of them."

Investigator: "And how do you think the dictionary would put it? How would you put it in the dictionary?"

M: "Eh yes . . . ehm, 'a sympathetic person' . . . or so; that it is stated like that."

Stephanie (low verbal), too, showed some awareness of what a definition might look like, although she did not use an appropriate part of speech in the following example.

Investigator: "What is your idea about the meaning of <altruist>?"

S: "I think that it just means that you don't keep everything for yourself and that you do, that you do something for someone else, also . . . just like that man that goes to the other country to help those people over there and that he is not only considerate with himself but also with another person, that he is respectful."

Investigator: "And how do you think the dictionary would put it? How would you put it in the dictionary?"

S: "That you do not give everything to yourself, but that you also give something to others. To take, but to give too."

Investigator writes the answer down.

For students such as Marc, who perform some kind of cumulative testing, defining was relatively easy. These students already keep, so to say, a running summary of elements of meaning of the target word. Other students, such as Stephanie and Cynthia (see the Appendix), find defining more difficult. Although precursory forms of cumulative testing facilitate keeping track of emerging elements of meaning for some time (sustained by phraseology), earlier elements of meaning tend to slip away in favor of new elements of meaning.

Summary of the Main Results of the Qualitative Analysis

The purpose of the qualitative analysis was to increase our knowledge about the skills in vocabulary-knowledge-oriented activities of students of both high and low verbal ability in the middle grades. The first conclusion was that the experimental conditions elicited such activities and that the task was neither too easy for students of high verbal ability nor too difficult for students of low verbal ability.

A second more general conclusion was that the differences between students of high and low verbal ability were relative rather than absolute. We found significant differences between the two groups, and the effect sizes were large. However, the differences within groups were considerable also. In analyzing the protocols, we saw moments when low verbal students performed vocabulary-knowledge-oriented activities rather effectively, as well as moments when high verbal students were engaged in activities that remained context-bound. We also found a lot of evidence of intrapersonal instability. One and the same student decontextualized elements of meaning at some moments, whereas he or she did not go beyond a sentence-core concept at other moments. A similar instability was observed in cumulative testing and defining. We think that this might be typical for the developmental stage of the students.

Discussion

The study was designed as an experiment, and students worked under experimental conditions on an experimental task. In free reading, for instance, it is highly unlikely that students would encounter the same word in three successive text passages with ample information about the word's meaning, enabling them to take full advantage of decontextualization, cumulative testing, and defining activities. The experimental conditions were designed to zoom in on activities that are difficult to observe under standard conditions. Although our students would certainly not have exhibited the same amount of vocabulary-knowledge-oriented activities under free conditions as they did under our experimental conditions, we have no indications that their activities were not authentic. Being guided through the experimental procedure by the investigator, the students found their own solutions for the meaning derivation problems they encountered. In general, the findings of this experiment are similar to the findings of investigations that took place in more natural circumstances. In common with Harmon (1998, 1999), for instance, we found that

the students were very unstable in their meaning-derivation activities, that they seemed to select on the spur of the moment, depending on the text passages and the words at hand.

Our study showed large, significant differences in the skills of students of high and low verbal ability. The main contribution is, however, that it increases our understanding of processes underlying vocabulary growth of students in the middle grades. In fact, we were impressed by the visibility of activities such as decontextualization and cumulative testing. Even at the small scale of our 45-minute experiment, we observed several relevant differences in performance of vocabulary-knowledge-oriented activities. From an educational point of view, we consider it favorable that not only were instances of high-quality performance found in the protocols of students of high verbal ability, but precursors of proficient performance were also found in the protocols of students of low verbal ability. This opens the way to strengthening, by training and instruction, capabilities that students already have.

In the foregoing, we mentioned an instruction program aimed at broadening students' range of word-meaning-derivation activities and at increasing their versatility to switch from context- and word-oriented activities toward vocabulary-knowledge-oriented activities (van Daalen-Kapteijns, Schouten van Parreren, & de Glopper, 1997). The program took eight lessons, in which the students practiced various activities; the activities were modeled by an assistant investigator. This program was but partly successful. From our present point of view, we think that it would be a major improvement if the instruction were not to capitalize on modeling, but first to induce students to discover what they can and cannot do on their own. When individual guidance of students, as in our study, is too time-consuming, guidance in small groups might be a good alternative (see also Goerss, Beck, & McKeown, 1999; Palincsar & Brown, 1984).

The present study focused on meaning-derivation activities that have been described as difficult (Miller & Gildea, 1987) and mainly suitable for mature students of high verbal ability (Elshout-Mohr & van Daalen-Kapteijns, 1987; van Daalen-Kapteijns

& Elshout-Mohr, 1981). The results of the present study showed, however, that even young students of low verbal ability are capable of good vocabulary-knowledge-oriented reasoning. The prerequisites for making this visible, are that texts be highly informative and that individual guidance be provided.

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Appendix: Thinking aloud protocol by Cynthia* for <dilemma>

Context 1.
Student: "I don't know what to do. My friend has invited me to go on holidays with her and her family. During the same period, however, my sister is getting married. If I go with my friend, I will miss the wedding, but if I stay at home to attend the wedding, I cannot go on holidays with my friend. It is a real dilemma . . . Yes, I think that it, that it is a problem for something, because, you see, you have to choose then and then eh, yes it simply is a problem . . ."
Experimenter: "So if I ask you, what have you found out about the meaning of dilemma, from this piece of text?"
Student: "Well, that it eh, is eh, a problem."
[Experimenter writes down: "that it is a problem."]

Context 2.
Student: "Yesterday in the kitchen it was a real dilemma for our dog. There were chips on the . . . there were chips on the table and a big piece of sausage on the kitchen unit. He was pacing . . . to and fro between the two and did not know what to start with. He would miss out on both chips and sausage if his owner came in . . . Yes again, he again has to make a choice." [Signals to the experimenter that she can write this down.]
Experimenter: "So if I ask you, what have you found out about the meaning of dilemma?"
Student: "Well, that he has to go and choose between the two."
[Experimenter writes down: "that he has to go and choose between the two."]

*Student's name has been changed.

Context 3.
Student: "Mary: What shall I do? I am asked to play with the first team of my club tomorrow, but I would also like to watch the match Ajax–Heracles . . . or something . . . on television. . . . Simone: I really don't think that's a dilemma. Ajax is going to win for sure, and the match is not going to be interesting. I think your choice is easy to make. Yes, well [laughs], again about that choice, he again has to choose between two things . . ."
Experimenter: "So if I ask you, what have you found out about the meaning of dilemma?"
Student: "well eh, that it has to be a choice."
[Experimenter writes down: "that it has to be a choice."]

Definition task.
Experimenter: "Now you have seen three pieces of text with the word dilemma, and what do you now think that . . ."
Student, being familiar with the procedure, interrupts: "Well that it has to be a choice, somehow between two things it has to be a choice . . ."
Experimenter: "And how do you think the dictionary would put it, or how would you put it in the dictionary?"
Student: "Eh, well simply that it has to be a choice."
[Experimenter writes down: "that it has to be a choice."]