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RUBEN G. FUKKINK

EFFECTS OF INSTRUCTION ON DERIVING WORD MEANING FROM CONTEXT AND INCIDENTAL WORD LEARNING

ABSTRACT. The effect of instruction on deriving word meaning from written context and incidental word learning was assessed in a randomised experiment. The experimental programme, based on the direct instruction of a strategy, produced neither a significant improvement of the skill of deriving word meaning from context, nor did the incidental word learning rate of the fourth grade, below-average readers increase. An effect of instruction on the skill of deriving word meaning from context and incidental word learning has historically been difficult to achieve; hence, an effect on vocabulary growth in the long run seems premature at this stage.

KEY WORDS: incidental word learning, reading strategy, vocabulary, word meaning, written context

1. INTRODUCTION

Research, teacher surveys and reading methodology textbooks since 1900 (Matsuda, 1987) consistently attest to the value of instruction related to deriving word meaning from written context. Students need effective strategies for coping with unfamiliar words encountered during reading since students in the middle grades encounter between 16,000 and 24,000 new words (Nagy, Anderson & Herman, 1987) in the approximately million words of text they read annually (Nagy, Herman & Anderson, 1985). Thus, primary students could benefit greatly by an efficient strategy for determining word meaning from unfamiliar words. Poor readers in particular frequently have fewer strategies and need explicit instruction in helpful and meaningful strategies (Tomesen & Aarnoutse, 1998).

Instruction to derive word meaning from context connects closely with the incidental word learning hypothesis (Jenkins, Stein & Wysocki, 1984; Nagy et al., 1985) that students glean some word meaning from some unfamiliar words they encounter during reading. Incidental word learning involves not only meaning derivation but also the memorisation of the form and word meaning. In a recent meta-analysis of incidental word learning, Swanborn & De Glopper (1999) found that students learn an average of 15 of the 100 unfamiliar words during reading when word learning is measured directly after the reading event. However, word learning is

significantly correlated with grade level and age. Younger readers learn fewer words incidentally during reading. Grade 4 students, for example, learn only three to five percent of unfamiliar words during reading.

Jenkins, Matlock & Slocum (1989) stress the vital link between instruction in extracting word meaning from context and incidental word learning. They conclude that specific instruction, therefore, has "a sound and persuasive rationale" (Jenkins et al., 1989: 218) because even a small improvement in ability to infer word meaning of unfamiliar words would result in a sizeable number of words learnt over time. Herman & Dole (1988) also agree that instruction "has the potential of helping students become better independent word learners," stressing that this is "a valuable strategy considering the large number of words involved" (Herman & Dole, 1988: 49).

Much research investigated various instructional techniques and strategies for determining word meaning from context (Peterson, 1942 [cited in Guarino, 1960]). Clue instruction was followed by context clue classifications (Artley, 1943; McCullough, 1943). In clue instruction, students learn to recognise and use clue types (e.g. the synonym and antonym clue). In the 1970s, cloze tests emerged as an instructional strategy (see Jongsma, 1971), where texts contained blank spaces with specific words omitted to draw students' attention to the context. In the 1980s, reading comprehension instruction moved from text-oriented to cognitively-based instructional strategies (see Baker & Brown, 1984; Dole, Duffy, Roehler & Pearson, 1991; Paris, Lipson & Wixson, 1983; Pearson & Fielding, 1991). Furthermore, there was a growing awareness that explicit clues do not occur frequently in texts and, thus, researchers sought to provide a generic strategic approach, based on a process analysis of the reading task (e.g. Carnine, Kameenui & Coyle, 1984; Herman & Weaver, 1988; Kranzer, 1988; Jenkins et al., 1989). Consequently, students were taught a systematic approach that included searching for clues in the context, thinking of a meaning for unfamiliar words, and testing the fit of the tentative answer. Instruction in this field has moved from text-oriented clue instruction to reader-oriented strategy instruction. Finally, simple, organic practice in reading itself has been recommended (Kuhn & Stahl, 1998).

Reviews of research summarising study results have been cautious, if not negative (see Graves, 1986; Beck & McKeown, 1991). First, two recent reviews point out that experiments conducted to date have only assessed the instructional effects on the skill of determining word meaning from context (Fukkink & De Glopper, 1998; Kuhn & Stahl, 1998). Only Kranzer (1988) explored incidental word learning measures. Hence, it remains

unclear whether specific instruction enhances incidental word learning. This is an important observation because many researchers have emphasised the importance of transfer to incidental word learning and vocabulary growth.

Second, until recently, the efficacy of instruction remained undisputed. In their review of 14 studies, Kuhn & Stahl (1998) conclude that "it is likely that students benefit as much from practice in deriving word meaning from context as they would from instruction in either a specific set of strategies or a list of clues" (Kuhn & Stahl, 1998: 129). They based their findings on studies that included a practice-only group and did not find statistically significant differences between this condition and the experimental treatment. Fukkink & De Glopper (1998), however, point out that practice increases the skill of forming word meaning from context, though instruction produces a greater and more reliable effect. In their meta-analysis of 22 treatments from 12 studies, they found an average instructional effect of 0.43 standard deviation. In an explorative analysis, clue instruction appeared relatively effective compared to other instructional strategies. Furthermore, the effect of instruction increased when delivered to smaller groups.

In sum, it appears that the skill of determining word meaning from context is amenable to instruction even though not every strategy appears successful. Although experimental evidence for the effect of some instructional strategies exists, the instructional effects on incidental word learning needs further study. Strategy instruction shows promise because students learn a generic, systematic approach not restricted to specific clues (see also Fukkink & De Glopper, 1998). Younger and below-average readers with limited vocabulary prove a promising target population. Since younger children learn relatively few words incidentally during reading (Swanbron & De Glopper, 1999) and the poor readers from this group possess inadequate strategies for establishing word meaning from context (Tomesen & Aarnoutse, 1998), the study presented here aimed to determine the effect of strategy instruction on achieving word meaning from context and incidental word learning with fourth-grade, below-average primary students.

2. METHODOLOGY

2.1. Participants

Participants included 145 fourth-grade students (age 9–10) from seven Dutch primary schools in Amsterdam. Dutch is the native language of 72%

of the students. These students scored below grade level on a standard-
ised reading vocabulary test using a representative sample of 30 words
from a primary school dictionary (Verburg & Huijgen, 1994) by using
a multiple-choice test. The students' average score corresponded to an
estimated reading vocabulary of 8,000 words; the average Dutch student
recognizes between 10,500 to 11,000 words or between 2,500 and 3,000
more words. We selected a sample of below-average readers because
students lagging behind in vocabulary frequently experience difficulties
in invoking strategies for dealing with unfamiliar words (Tomesen &
Aarnoutse, 1998).

2.2. *Design*

A randomised experiment with pre-test and post-test design (Cook &
Campbell, 1979) was used to examine the effects of instruction. Students
were allocated randomly within each school to the experimental condition
or an untreated control group after matching for their ability of deriving
word meaning from context. The pre-test occurred in March 2000 and the
post-tests after completion of the treatment, approximately six weeks later.

Assuming an expected effect size of 0.43 standard deviation found in
Fukkink & De Glopper (1998), the meta-analysis of the *a priori* statis-
tical power for detecting a significant difference is 0.68 with a normal *F*-
test. The statistical power increases to 0.95 when covariance analysis is
applied, assuming a correlation of 0.70 between co-variates and dependent
variables.

2.3. *Instructional Programme*

The goal of the instructional programme to improve meaning derivation
skill and establish transfer to incidental word learning included learning a
strategy (see below) for dealing with both simple and complex words in
textual contexts with varying degrees of contextual support: for instance,
distinguishing between a synonym clue (for example, "Columbus leaves
the port with three *caravels*. One *ship* is called 'Santa Maria,' the other
one 'Pinto' and the third 'Nina' "); an antonym clue ("The school trip
was *a success* this year. But last year the school trip was *a fiasco*"); and
direct explanation clues ("Every day is the same: sailing, sleeping, sailing,
sleeping. There is nothing else to do. And they see only water every day,
everywhere they look around. There is nothing else to see. Life aboard is
therefore very *monotonous*. They are bored stiff.")

I conducted a pilot study of the instructional programme at one school
not involved in the formal study, where one class of students participated.
I observed the lessons and adjusted the processes for the formal study. The

12 lessons took approximately 45 minutes each and included the direct instruction model for teaching and learning implicit skills (Veenman, Lem, Roelofs & Nijssen, 1993; see also Palincsar & Brown, 1989; Pressley, Snyder & Cariglia-Bull, 1987; Rosenshine & Stevens, 1984, 1986; Stahl, 1997). Direct instruction aimed at applying the strategy by providing the declarative, procedural and conditional knowledge (Paris, Lipson & Wixson, 1983; Winograd & Hare, 1988). Explicit think-aloud strategies were included to represent the mental processing involved in the strategy (Bereiter & Bird, 1985; Duffy & Roehler, 1989; Herman & Dole, 1988; Kucan & Beck, 1997; Silvén & Vauras, 1992).

The strategy involved four steps: (a) searching for an answer; (b) thinking of the answer; (c) checking the answer; and, (d) formulating a definition. The first step involved looking for a synonym, antonym or other word clues that inferred the meaning. This was followed by generating a (tentative) answer. Starting with explicit clues in supportive contexts proved effective in helping younger readers (Fukkink & De Glopper, 1998). However, the study aimed to develop and apply a more generalizable ability. Context clues played no central role in the remaining lessons. Checking the answer involved substituting word in the original sentence and evaluating its appropriateness in the specific sentence and context. Substituting an answer in the original sentence has been applied with some success by primary students (Van Daalen-Kapteijns, Schouten-van Parreren & De Glopper, 1997).

Formulating the definition teaches students to define an unfamiliar word as precisely as possible. This definition style, which may be associated with or even encouraged by the substitution strategy, often leads to partially correct answers with conceptually complex words. Since no synonyms exist, students need more words to generate a clear definition. For example, we observed some students defining a target word like "dilemma" with relatively rich, tentative answers such as "problem in choosing" or even "problem in choosing between two things." In the end, however, they selected only the word "problem" as a final answer.

Students were encouraged to apply the strategy during actual reading. Looking for unfamiliar words during reading and gleaning their meaning from context was practised with texts from the workbook and other texts during the final three lessons.

The instructional programme also used a strategy involving solving riddles (see Buikema & Graves, 1993) and guessing the meaning of "Smurf words" in a comic and text. The search strategy involved looking for synonyms, antonyms and general clues before and after the unfamiliar word introduced in lessons 2, 3 and 4, respectively. In lesson 4, students

worked in triads: one student looked for words "that mean the same," another one for "words that mean the opposite," and a third for "other words that help in guessing" the meaning of the unfamiliar word. Students alternated roles. Lesson 5 focused on checking for correctness by substituting an answer in the sentence that deleted the difficult word and check the fit with the text (a "cloze" procedure). In lesson 6, students in the triad distinguished between searching for, "thinking of," and checking the answer. These strategies were performed consecutively by three different students. Students practised the same sequence individually in lesson 7 and in lesson 8 were instructed to define words as precisely as possible. Practise began with familiar words (e.g. "a pebble is a ... stone"; "a boulder is a ... stone"). Again, the instructional steps were integrated in lesson 9.

Lesson 10 switched to incidental word learning to promote and facilitate transfer. In a larger text, target words were highlighted with a stop sign first, but students had to locate the unfamiliar words in the remaining lessons after having been instructed to "Keep your eyes open for unfamiliar words in the rest of the text." Lesson 11 required students to find and define difficult words using a selection chosen by the teacher from a regular school textbook. Lessons 10 and 11 aimed to apply the strategy to facilitate skill transfer. The study ended with individual students independently reading a text.

2.4. Tests

A pre-test measured reading vocabulary and skill levels of related to word meaning in written texts. The post-test measured incidental word learning, as well as eliciting word meaning from context. All tests had been pretested in a pilot study prior to the study in different schools.

2.5. Deriving Ability Test (DAT, Form A and B)

A sample of presumably unfamiliar words were selected from a Dutch primary school dictionary (Verburg & Huijgen, 1994) and primary school texts (Schrooten & Vermeer, 1994; grade 6 level). A small number of words from children's books on a selected topic (the expedition of Columbus) were added to this list to construct the incidental word learning test (see below). The resulting 123 words were ranked by three judges to determine those requiring "simple synonyms" (SS). The three judges averaged a 79.7% agreement (Brennan & Prediger, 1981). Only words receiving unanimous agreement were selected for the final list.

Constructing brief texts (approximately 60 words) minimised dependency among test items. Some texts contained a clue (synonym, antonym or a direct explanation clue; indicated with a "+" sign below); others did

not (indicated with a "−" sign below). The selected clues were those most commonly represented in the different classifications (see Boettcher, 1980; Rankin & Overholser, 1969; Sternberg, Powell & Kaye, 1983), they were relatively common, and had been dealt with in different subject areas (Fukkink & De Glopper, 1998).

The texts without explicit clues offered less contextual support. The SS and CC items with or without explicit contextual support were randomly placed in the test. Only the first items of the two versions of the derivation test required one-word synonyms. The items were pre-tested with "untrained" students. Two parallel test halves were constructed based on the p values of the pilot study. Each consisted of 23 items. For Form A, item distribution included: 6 SS+; 3 SS−; 7 CC+; and 7 CC− words; for Form B: 5 SS+; 3 SS−; 9 CC+; and 6 CC− words.

Knowledge of the target words was evaluated by distinguishing between the percentage of correct attributes and the presence of a false attribute (see also Fukkink, Blok & De Glopper, 2001). The percentage of correct attributes (PCA) depended on the number of semantic attributes specified in the dictionary definition and the number of attributes in the students' definition. For example, the dictionary defines "expedition" as an "investigative journey." If a student defined "expedition" as "journey," only one of two relevant attributes, the student received a 50% score. An answer was considered fully correct (a 100% score) if it provided an accurate synonym or contained all the appropriate attributes. Synonyms and their attributes were provided for each word to improve inter-coder reliability. Second, false attributes (FA) were scored. The code specifications contained a short, non-exhaustive list of incorrect answers for each target word ("expedition" defined as "experiment," "exposition" and "story," for example).

2.6. Incidental Word Learning Test (IWLT)

The incidental word learning test used narrative and expository text. The narrative text was an 812-word selection from a slightly modified Dutch translation of a Margaret Mahy work. The expository text consisted of 766 words from a children's book on Columbus' voyage. The readability of both texts was adjusted to a grade 4 level using the CLIB reading difficulty index (Staphorsius & Verhelst, 1997). SS and CC words were incorporated without explicit context clues. Ten target words from the compiled word list (described above) were incorporated in the narrative text and distributed as follows: 4 SS+; 3 SS−; 2 CC+; and 1 CC− word. Target words for the expository text included: 2 SS+; 1 SS−; 6 CC+; and 2 CC− words. Word knowledge came by way of a definition task and a multiple-

choice test for each of the 21 target words. In both tests, five key words from each story were added to the unfamiliar target words. These 10 words aimed to minimise students' frustration in completing the incidental word learning test (Swanborn & De Glopper, 1999). The control words made it also possible to check whether students understood the key concept in each text and provided insight in the students' definition skills of familiar words. The control test items were not included in the test scores for incidental word learning.

Scoring definition tasks was identical to the DAT scoring, namely, distinguishing between the percentage of correct (PCA) and incorrect attributes (see also Fukkink, Blok & De Glopper, 2001). If no answer was supplied, which occurred frequently in the incidental word learning test, a zero score was coded (i.e. no incorrect attribute).

Each multiple choice stem included one of four possible choices: two correct distractors for other target words from the same text (see Nagy et al., 1985, 1987) and one distractor being an actual word resembling the target word but not semantically related (e.g. the word "experiment" for the Dutch target word "expeditie," meaning "expedition"). Table 2 reports the percentage of correct answers.

2.7. Reading Vocabulary (Voc)

The vocabulary test contained a representative sample of 30 words from a primary school dictionary (Verburg & Huijgen, 1994). Knowledge of these words is tested with a multiple-choice test with four options. The test is standardised and provides an indication of students' reading vocabulary size in terms of number of words.

2.8. Measurement Procedure

Students completed the pre-test including the reading vocabulary and the DAT (form A) and the IWLT as the post-test. The classroom teacher distributed the test urging students to "Enjoy reading this story." With the expository text, the teacher instructed the class to "Read the text carefully. You'll have to answer some questions later" (Swanborn & De Glopper). No reference was made to earlier instruction, vocabulary test or difficult words to create as normal a reading experience as possible. The textual layout differed from the experimental materials. The order of texts was alternated between schools. Knowledge of target words from the IWLT was measured first with a definition and second, a multiple-choice test. Narrative and expository words were separated in these tests. Before each test, students learned where the words originated. Word order in the tests

repeated the order in the reading session. DAT form B was administered the following day.

2.9. Implementation

In the experimental classes, experienced teachers (5 years or more) participated in in-service training in teaching practices before and during the experiment and prepared detailed lesson plans. Before the experiment, training focused on the direct instruction model. During the experimental programme, training concentrated on implementing the strategies through direct instruction and practising think-aloud protocols. Teachers met twice weekly to discuss future lessons and track the implementation. Implementation also included weekly scoring of a 23-item list (Veenman et al., 1993) to assess the session integrity (implementation of all components for a single lesson) and component integrity (implementation of a particular component across lessons). Teachers scored each item with a "+", "+/−" or "−", scored as 1, 2 and 3, respectively. Average scores for the component and session integrity were determined after the inversion of negatively formulated items.

Teachers reported that each lesson began with an introduction (1, sd = 0) to invoke prior knowledge (1, sd = 0). During instruction, teachers specifically stated the goals (1.05, sd = 0.16). Instruction was divided in small sequential steps (1, sd = 0). Students appeared able to follow instruction (1.3, sd = 0.48), indicating the value of the strategy (mean score: 1.5, sd = 0.55) and the ability to apply what they had learned (1.6, sd = 0.49). Demonstrating the strategy using think-aloud protocols proved fairly adequate (1.4, sd = 0.52).

During the next phase, individual students knew what to do (1.1, sd = 0.32), though, sometimes, students were distracted (1.5, sd = 0.67) and participated in off-task behaviour (1.56, sd = 0.50). Teachers checked mastery of the subject matter (1.44, sd = 0.53), and if off-task behaviour was connected to lesson content (1.3, sd = 0.48). However, teachers did not often provide feedback that went beyond "good" or "wrong" (2, sd = 0) or stimulate student reflection (1.75, sd = 0.46).

Process feedback was only infrequently provided (1.43, sd = 0.53) and teachers did not always summarise the content of the lesson (1.6, sd = 0.52). Teachers found most lessons proceeded without interruption (1.0, sd = 0) and were well structured (1.1, sd = 0.32). Furthermore, teachers found that the students who actively engaged in the lesson (1.2, sd = 0.46) were not often distracted (1.25, sd = 0.46) and achieved the lesson goals (1.17, sd = 0.35). Teachers generally responded positively to the lessons (1.1, sd = 0.32). The session viability averaged 1.36 (sd = 0.17), varying between

1.15 and 1.70. Sessions 4, 6, and 10 proved less successful, perhaps due to the unfamiliar, challenging carousel format. Achievement scores were lower for lesson 10 because of reduced instructional time when students were expected to work their way through a relatively long text. After each lesson, students indicated how many exercises they completed (10 on average). A random sample revealed that most students completed all the exercises. Furthermore, teachers did not report significant student absence.

In sum, the component and session scores and the worksheet information confirm the implementation of the instructional programme. The new instructional format of two of the lessons (i.e., 4 and 6), and some complex elements of the direct instruction component proved more difficult to implement, but the overall realisation of the programme seemed satisfactory.

2.10. *Analysis*

Effect sizes were calculated using Hedges d, based on the pooled sample standard deviation and adjusted for bias due to small sample size (Hedges & Olkin, 1985). Students missing one test score had missing values estimated, using the expectation–maximisation function (EM). This happened infrequently and varied between 0 (Voc) to 3.6 (DAT, form B). Six students from different schools where two test scores were missing were removed from the analysis, leaving a total of 139 students.

Data analysis revealed that IWLT variables (the multiple-choice test – PCA and FA in particular) were not normally distributed. A square root of these variables computed to normalise the data led to a slight improvement in the distribution for the multiple-choice test and the FA measure, but not the PCA. Analyses were performed for both raw and transformed scores for the multiple-choice and the FA measure.

Because the data structure is hierarchical with students nested in schools, multi-level regression models were specified for each dependent variable. Each analysis started with an intercept-only model without explanatory variables to estimate the intra-class correlation and a value of deviance. This can be written as: $Y_{ij} = \beta_{0ij} + [u_{0j} + e_{0ij}]$. The random part of the model is indicated between brackets, distinguishing between a residual score at school (u_{0j}) and student level (e_{0ij}).

In the next phase, a full model was analysed with the co-variates and a placebo variable for the treatment factor fixed to assess the contribution of each individual explanatory variable. It was decided to enter the PCA measure of DAT (Form A) as a co-variate for the related PCA measures for determining both word meaning from context and incidental word learning during the post-test, i.e. DAT PCA (Form B) and IWLT PCA. The

TABLE 1

Reliability of tests (Cronbach's α) for experimental and control group and total.

	Experimental ($n = 71$)	Control ($n = 68$)	Total ($n = 139$)
DAT Form A (k = 23)			
PCA	0.79	0.79	0.79
FA	0.81	0.80	0.80
Vocabulary test	0.79	0.80	0.80
DAT Form B (k = 23)			
PCA	0.77	0.74	0.75
FA	0.72	0.71	0.72
IWLT (k = 21)			
PCA	0.80	0.67	0.75
FA	0.83	0.68	0.79
Multiple-choice	0.84	0.77	0.81

DAT – deriving word meaning from context; vocabulary – reading vocabulary; IWLT – incidental word learning (PCA – percentage of correct attributes; FA – incorrect attribute).

PCA measure of DAT (Form A) was the co-variate for the analysis of the multiple-choice version of the IWLT. The FA measure at the pre-test was a co-variate for the FA measures for both skills at the post-test, i.e. DAT FA and IWLT FA. Reading vocabulary (Voc) and the dummy variable "native Dutch speaker" were always entered in the model as co-variates in the full model. The resulting model is: $Y_{ij} = \beta_{0ij} + \text{Co-variate}_{ij} + \text{Voc}_{ij} + \text{Native}_{ij} + \text{Treatment}_{ij} + [u_{0j} + e_{0ij}]$. Whether randomising these predictors at student or school level improved the fit by testing the relative improvement of fit was analysed on an individual basis ($\Delta\chi^2$ at Δ df) to arrive at a final model (see Bryk & Raudenbusch, 1992; Hox, 1994; Snijders & Bosker, 1999). All tests were performed at $\alpha = 0.05$.

3. RESULTS

Reliability of the different tests proved satisfactory with values for Cronbach's varying between 0.70 and 0.80 for the total group. Table 1 reveals that the internal consistency for the incidental word learning measures was slightly higher for the experimental group.

As expected, the experimental and control groups scored similarly on the pre-tests. No statistically significant differences for the PCA measure exist [$F(1,137) = 0.02$, $P = 0.88$, and the FA measure of the DAT (Form

TABLE 2

Means (and standard deviations) and Hedges' *d* for the experimental and control group at the pre-test and post-test.

	Experimental (*n* = 71)	Control (*n* = 68)	*d*
Pre-test			
DAT Form A			
PCA	27 (12)	27 (11)	0.00
FA	0.58 (0.18)	0.57 (0.19)	0.05
Vocabulary test	17.7 (5.3)	18.5 (5.4)	−0.15
Post-test			
DAT Form B			
PCA	28 (13)	28 (12)	0.00
FA	0.70 (0.15)	0.70 (0.13)	0.00
IWLT			
PCA	10 (11)	9 (9)	0.10
FA	0.23 (0.19)	0.19 (0.13)	0.24
Multiple-choice	39 (22)	37 (20)	0.09

DAT – deriving word meaning from context; vocabulary – reading vocabulary; IWLT – incidental word learning (PCA – percentage of correct attributes; FA – incorrect attribute). The FA measures are "negative" variables, and a positive *d* score indicates thus a lead for the control group here.

A), $F(1,137) = 0.22$, $P = 0.64$]. Differences were not significant for the vocabulary test, $F(1,137) = 0.66$, $P = 0.42$. The proportion of native Dutch speakers corresponded with 72% in the experimental group and 71% in the control group. Table 2 demonstrates the means and standard deviations of the experimental and control group at the pre-test and post-test are displayed.

Students include about a quarter of the correct attributes in their definition when deriving meaning from context at the DAT. An incorrect attribute is included in 60 (pre-test) to 70% (post-test) of students' definitions. These scores are comparable generally to the results found by Fukkink et al. (2001), using the same measures, although the PCA values are slightly lower in the present study. Higher scores were achieved for items with clues (PCA scores are 0.42 and 0.33 for pre-test and post-test, respectively) than for items without clues (0.22 and 0.20). In addition, simple synonyms prove easier (PCA = 0.53 and 0.34 at both the pre and post-test levels than concept challenging words (0.21 and 0.25).

Correct attributes for the IWLT resulted in a 10% score. An incorrect attribute was included in one-fifth of students' definitions. This latter proportion cannot be directly compared to the contextual word meaning test because students always supplied an answer for the latter test, whereas they skipped items on the incidental word learning test if they could not supply a definition (55% *versus* 59% for the experimental and control group, respectively). Adding proportion of definitions with incorrect attributes and skipped items leads to a 78% score for both groups. The word learning chance measured by the multiple-choice test indicates a higher score [38%, as expected (the chance level is 25%)].

Students show better results for the 10 control words from the incidental word learning test, as expected; 68 (sd = 17) *versus* 73% (19) for the PCA measure and 0.23 (0.20) *versus* 0.17 (0.14) for the FA measure for the experimental and control group, respectively. Multiple-choice test scores achieved a 95% correct score for both groups (sd = 9). Considering the nearly perfect performance of the multiple-choice test, a score around 70% may therefore be interpreted as the maximum score at the DAT.

The correlation between deriving word meaning from context and incidental word learning measures are modest with 0.37 for the corresponding PCA measures (DAT-B PCA and IWLT PCA) and 0.19 for the FA measures (DAT-B FA and IWLT FA). Correlation is similarly modest for the multiple-choice measure of incidental word learning and deriving word meaning from context (pmc = 0.28 for IWLT multiple-choice and DAT-B PCA; pmc = −0.20 for IWLT multiple-choice and DAT-B FA).

Table 2 makes clear that experimental and control group performed comparably on the pre-test and the post-test. The experimental differences are negligible (Cohen, 1988). The comparability of findings for students from both groups is confirmed by the multi-level tests (Table 3).

After entering reading vocabulary scores, the co-variate "native speaker" is not a significant predictor in any model. Interestingly, the treatment factor is not significant either for all dependent variables. Analysis of the transformed variables IWLT MC and FA lead to the same results. Neither the skill in determining word meaning from context, nor the incidental word learning rate improved by the instruction.

4. DISCUSSION AND IMPLICATIONS

No improvement in deriving word meaning from context and incidental word learning occurred as a result of the instructional treatment. Before interpreting this finding, the implementation and threats to the internal validity of this study should be considered.Various efforts were made to

TABLE 3

Estimated parameter values for the fixed and random parts for the final models (and standard errors); the conditional intra-class correlation (ρ) and the proportion of variance accounted for at student-level (R_1^2).

| | Measure | | | | |
| | DAT (Form B) | | | IWLT | |
	PCA	FA	MC	PCA	FA
Fixed parameters					
Intercept	0.75 (3.05)	77.6 (7.25)	15.8 (7.1)	−1.68 (3.41)	41.0 (10.6)
DAT A					
PCA	0.41 (0.09)	–	0.56 (0.19)	0.35 (0.09)	–
FA	–	0.24 (0.06)	–	–	−0.08 (0.10)
Vocabulary	0.85 (0.20)	−1.12 (0.23)	0.44 (0.43)	0.08 (0.20)	−1.07 (0.34)
Native	0.30 (1.73)	0.49 (2.03)	0.38 (3.77)	0.15 (1.69)	4.84 (3.03)
Treatment	0.42 (1.42)	−1.78 (1.66)	2.11 (3.09)	1.46 (1.38)	3.70 (2.49)
Random parameters					
Schools	10.5 (7.9)	24.1 (16.2)	89.7 (59.6)	28.3 (17.5)	26.7 (21.4)
Students	69.5 (8.5)	95.2 (11.7)	329.1 (40.5)	65.8 (8.1)	213.2 (26.2)
ρ	0.13	0.20	0.21	0.30	0.11
R_1^2	45%	38%	9%	14%	12%

DAT – deriving word meaning from context; vocabulary – reading vocabulary; IWLT – incidental word learning (MC – multiple choice; PCA – percentage of correct attributes; FA – incorrect attribute). A dash indicates that the variable is not entered into the model.

implement the programme as closely as intended, particularly the direct instruction and strategies because of their rather complex nature. In addition, few observations of strategies for independent word learning occurred (Aarnoutse & Weterings, 1995; Becker & Carnine, 1980; Duffy & Roehler, 1989; Durkin, 1978–1979, 1984; Fisher, 1989; Inspectie van het Onderwijs, 1998, 1999; Matsuda, 1987; Veenman, 1992; Watts, 1995). Moreover, complications in implementation leaves room for improvement. Nevertheless, enough consistency in implementation occurred to suggest adequate implementation.

The outcome of any randomised experiment may also be influenced by factors that threaten the internal or construct validity. Frustration resulting from implementation and other demands on teachers and/or students can influence the results of a randomised experiment (Cook & Campbell, 1979; Reichardt, 2000). However, the internal validity of this study does not seem to be seriously threatened. To conclude, the non-significant findings of this study are not likely to be explained by inadequate programme implementation or any factor that seriously undermines the internal validity.

The programme combined instructional strategies that have shown encouraging results (Buikema & Graves, 1993; Tomesen & Aarnoutse, 1998; see also Slawson, 1991). The combination was framed in an instructional format implemented in other studies, although, several innovative elements were incorporated. The length of the programme and frequency of the lessons were in line with other related studies (see Fukkink & De Glopper, 1998).

Two differences between this study and other studies seem relevant. First, regular classroom teachers provided the instruction. Generally, researchers or specially trained teachers teach the students (see Fukkink & De Glopper, 1998; De Glopper, Fukkink & Swanborn, 2000). Hence, the positive effects found in some studies may not be generalised to more representative field settings. Tomesen and Aarnoutse (1998) found an impressive effect in a small-scale study where one researcher offered the instruction ($d = 1.53$) though no significant effect could be found in a follow-up study (Rijskamp, 1998; $d = -0.29$). A re-analysis of Fukkink & De Glopper's (1998) meta-analysis indicates that instruction by the researcher rather than the regular teacher produces more positive results ($d = 0.61$ and 0.31 respectively). This suggests that the effects of experimental studies in special settings may be limited and may not apply to typical field settings.

Second, the programme in the present study seems relatively ambitious compared to other studies. The instruction focused on a four-step strategy instruction involving not only the recognition and use of synonym and antonym clues, but also other topics. Students were taught how to deal with texts without specific instructional clues, how to formulate an explicit definition, and how to apply the strategy in the context of general reading. Furthermore, the unfamiliar words consisted of both words requiring simple synonyms (SS) and more complex words (CC). This relatively broad scope was reflected in the post-test, where students had to gather the meaning of SS and CC words from both highly supportive and less supportive contexts. The same applies to the incidental word learning test. The standards were thus expanded and raised from previous studies with a primary focus on word meaning [with the exception of Kranzer (1988)]. In addition, previous clue instruction studies instructed students in a small number of explicit clues and tested on only these specific clues. From this perspective, the instructional time and the opportunity to practise may have been too short, considering the relatively rich content of the training and the tests.

5. IMPLICATIONS

Deriving word meaning from context appears amenable to instruction (Fukkink & De Glopper, 1998; Kuhn & Stahl, 1998). The absence of a positive outcome of this study suggests that instructional effects may be restricted to explicit context clues. It remains to be investigated how instruction improves students' skills in determining word meaning from both supportive and less supportive contexts. It may take more time and experience to improve such a challenging, meta-linguistic skill.

This study demonstrated no effect for incidental word learning, an outcome confirmed in other research that tested for incidental word learning directly after instruction (Kranzer, 1988). Instructional effects, therefore, still remain to be established. It should be noted, however, that effect on the rate of incidental words learnt cannot be expected to result from this study since no significant gain was found for determining word meaning from context.

Research suggests that students' perceptions of vocabulary learning task during reading varies considerably. Harmon (1996) interviewed a number of students and found that some showed a keen interest and awareness in learning new words during reading, whereas others did not.

A low correlation exists in this study between deriving word meaning from context and incidental word learning across the different scoring methods. Though Kranzer (1988) reports a higher correlation ($r = 0.67$), she notes that this estimate is unreliable because the two skills were tested using the same test material. More than half (Kranzer, 1988) to about 90% of the variance (this study) in incidental word learning measure remains unaccounted for. This is not surprising since incidental word learning not only involves meaning derivation but also memorisation of word form and meaning. Thus, determining word meaning from context integrates with other skills in the incidental word learning process. Furthermore, the reading situation influences incidental word learning. A reader may not notice unfamiliar words under normal reading circumstances, or if s/he does, ignores them to focus on global text meaning (Stallman, 1991).

Future research should seek ways to develop and enhance incidental word learning and the relevant sub-skills involved to extend the prevailing focus on deliberately deriving word meaning from context. This study implemented cumulative steps and only later in the process shifted the process to incidental word learning. Only after completing formal instruction was it applied to typical, general reading. This sequential approach contrasts with Kranzer (1988), where deriving word meaning and incidental word learning strategies were combined from the beginning, and explicit focus on deriving meaning from context was only introduced

in extension activities following silent reading. This approach weaves incidental word learning and deriving word meaning from context into instructional strategies that encourage students to integrate the new skill into their general reading behaviour.

The lack of instructional effects both in word meaning and incidental word learning clearly demonstrates that accelerated vocabulary growth is not present in current programmes. These three variables have been linked in a three-stage process. It was assumed that instruction would lead to improving the skill of deriving word meaning from context, which was followed by increased incidental word learning, and would result in accelerated vocabulary growth (Jenkins et al., 1989). This triple relationship has only been partially explored. Not every instructional strategy, however, proved successful; the strongest effects were found in using limited context clues (Fukkink & De Glopper, 1998). In addition, the gap between deriving word meaning and incidental word learning has been difficult to bridge, and the projected effect of context instruction on vocabulary growth remains premature. Future research needs to refine the instructional strategies and effects, as well as the transfer of learning to typical reading tasks.

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