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ABSTRACT

A study applying schema theory to the teaching and learning of second language linguistic structures is reported. Subjects were students in the English language program of an Austrian university's school of business administration. The experimental groups received 8 hours of instruction in the schematic attributes of learning processes and then taught lessons from the regular notional-functional syllabus. The control groups were taught only the syllabus. All groups were compared on their performance on a multiple-choice test. Results indicate that the experimental groups had significantly greater achievement gains on the target linguistic structures. It is concluded that schema training facilitates acquisition of both grammar and vocabulary and also inhibits language loss over time, perhaps by structuring information for better retention and recall. The results also suggest further directions for research in this area. Contains 47 references. (MSE)

SCHEMATA AND SECOND LANGUAGE ACQUISITION

Thomas Cullen

Abstract

This study attempts to expand the application of schema theory in second language pedagogy to include the teaching of linguistic structures. It was hypothesized that the teaching of a general schema for a content domain - the schema for "process" - would facilitate the acquisition of language structures employed in describing and discussing that domain. This hypothesis is a departure from previous work in that the acquisition of linguistic structures may be seen as qualitatively different from the improvement of comprehension and recall that has previously been demonstrated by reading researchers (c.f., Carrell 1984, 1987). This paper describes an experiment in which experimental subjects were given training in the schematic attributes of processes before being exposed to language instruction while control subjects received only the language training. The findings indicate that the experimental subjects performed significantly better in learning the target linguistic structures.

INTRODUCTION

The hypothesis that schemata underlie language comprehension has been evaluated in detail over the last two decades (Gordon 1980; Singer and Donlon 1982; Carrell 1984, 1987; Chang and Dunkel 1990; Roller and Matambo 1992). Emphasis on the interaction between language input and prior knowledge has helped to explain listening and reading comprehension in a manner which has had immediate applications for teachers, curriculum planners, and materials designers. Although techniques based on this approach have become widely practiced in a range of teaching situations (c.f., Adelson 1984; Chase and Simon 1973; de Groot 1965; Greeno 1980) the study and use of schemata as pedagogical

constructs in second language teaching has been limited primarily to reading. Specifically, several training studies based on schematic representations for text structure and content have been conducted. Singer and Donlon (1982) demonstrated that schemata for simple stories can be taught, and that such instruction improves performance on measures of comprehension and recall. Gordon (1980) compared various instructional strategies for teaching schemata in natural classroom settings and found that individuals who received instruction designed to improve pre-existing content schemata and knowledge of text structure showed greater comprehension of narrative text than those who received training in making inferences, or those who receive instruction in related literature. Short (1982) taught remedial reading students story grammar strategies to improve their use of story schemata. She found that after only three sessions, story grammar strategy training significantly enhanced less skilled readers' free and prompted recall performance. These and similar studies provide the background for the schema-theoretic work done in ESL by Carrell.

Employing Meyer and Freedle's (1984) categorization of text types, Carrell (1984a, b, 1985) documented the efficacy of familiarizing second language readers with the "formal schemata" - prototypical text structures - of various kinds of narrative and expository prose in order to improve the readers' understanding of texts. For example, she taught students a general schema for causality and trained them to identify causes as a cue to anticipate an effect. Her findings indicated that this technique improves comprehension and aids in eliciting cued and free recall from the text. She also measured the effects of teaching schemata which corresponded to the content of texts on reader ability to assimilate the basic meanings from texts (Carrell 1983a, b, 1984c). This approach was also shown to improve the skills of second language readers.

The present study expands the application of schema theory in second language pedagogy to include the teaching of linguistic structures. It builds on the experimental and instructional models used by Meyer and Freedle (1984) and Carrell (1985) which sought to

aid learners by teaching schemata which could be applied in a top-down fashion to systematize the learners' organization of ideas and thereby to improve comprehension and recall. The hypothesis that underlies the present study is that the teaching of a general schema for a content domain, such as *process*, will facilitate the acquisition of language structures employed in describing and discussing that domain. This hypothesis is a departure from previous work in that the acquisition of linguistic structures may be seen as qualitatively different from the improvement of comprehension and recall; it bears on the accumulation of new knowledge rather than simply recognizing the relationship of new input to prior knowledge. This hypothesis also refers to the "utilization" of new knowledge and, furthermore, to the beginnings of the proceduralization process whereby declarative knowledge becomes incorporated into the production system of a skill (c.f., Anderson 1983; Anderson 1984). Accordingly, the research described here can be seen as an elaboration of previous attempts to clarify the role of cognitive processes in the performance of language skills and as an effort to integrate the understanding of that role into the design of language learning curricula.

SCHEMA MODEL

At the most basic level a schema is defined as a unit of mental representation in which the concepts and relationships of a given semantic field are hierarchically organized and stored in memory. Several models of schemata have been proposed. Meyer and Freedle (1984) and Carrell (1985) have offered schemata composed of paired ideas which define a particular relationship, such as cause and effect. Minsky (1977) envisions schemata as frames or stereotypical representations of a category of phenomena, such as that for a landscape, in which the quintessential characteristics of that category define the frame[1]. In addition, frames have what Minsky describes as terminals: slots that are defined

[1] In the case of a landscape, the quintessential features delimiting the frame might include a horizon line, foreground and background. Elements such as trees, mountains or open spaces would be determined by the experience of the individual.

by the frame itself, and these slots are filled with the particulars of a given example of the frame. For instance, the frame for a child's birthday party would necessarily by comprised of a gathering of guests - probably children -, activities, and refreshments. The slots of this frame might accommodate specific guests, pin-the-tail-on-the-donkey, and Coca-Cola. The instantiation of a frame is the means by which new information is related to, and assimilated into, previously acquired knowledge structures.

Minsky extends his frame theory to encompass discourse by positing not only semantic frames of knowledge, but also thematic, narrative, and syntactic frames. Furthermore, he suggests that individual statements of a discourse correspond to semantically interpreted "deep structures" which are arranged to represent a scenario at the following levels:

Thematic:	scenarios concerned with topics, activities, portraits, and settings
Narrative:	skeleton forms for typical stories, explanations, and arguments
Semantic:	propositional bases for word choice where verbs represent propositional predicates and where and nouns, adjectives, and qualifiers depict relationships among propostional constituents
Syntactic:	mainly verb and noun structures; prepositional and word indicator conventions typical of the frame

These co-frames interact and overlap as they are instantiated in language comprehension and production. The Minsky model of schemata as frames thus accounts not only for the representation of knowledge, but also for different aspects of natural language behavior.

A MODEL OF SCHEMA PEDAGOGY

Gallini (1989) suggests that schema-theoretic pedagogy is most effective when it focuses on helping learners to identify underlying principles which relate information in a given category, to organize information according to those principles, and to recognize cues which will prompt instantiation of the appropriate schema. Carrell (1985) applied these

precepts as she taught L2 readers to formulate abstract representations of a given category of text type defined in terms of its contextual components, to develop conceptual hierarchies within the category, and to recognize the relationships between concepts. The schematic model for this study retains the generality and practicality of Carrell's (1985) approach. The schema-pedagogical model employed in this research took as its first objective the creation of a conceptual schema in the learners' cognitive systems. Specifically, learners were encouraged to employ bottom-up schema instantiation, whereby they were helped to abstract the schematic features of the concept of "process". Then top-down schema instantiation was practiced by encouraging students to impose the schematic relationships on new input. Language instruction and practice followed, during which students were taught to associate specific discourse structures with the relationships inherent in the concept of process.

METHOD

In order to test the hypothesis that learning a schema for process would improve the acquisition of language exponents commonly used to describe processes, a pre-test (T1) and post-test (T2) control group experiment was conducted. The control group (C), which met weekly for two hours over a period of eight weeks, was taught a notional/functional syllabus (X) which had the acquisition of grammatical and lexical structures common to the description of processes as its objective. An experimental condition (E) was exposed to a schema induction module for four two-hour sessions and then taught lessons from the control syllabus for the subsequent four two-hour sessions of the eight week module. The experiment was run during the Winter Semester 1991/92 and during the Summer Semester 1992; an additional experimental group was taught from the beginning of March 1992. Those in the control and experimental conditions were compared by their performance on a multiple choice test with learning gains of the process description target structures as the dependent variable..

PARTICIPANTS

The first experiments were conducted in the English Language Program of the Business Administration (BWL) Institute at the University of Klagenfurt. Typically, BWL students have studied English for up to 8 years in high school and must continue English study for eight semesters in order to partially fulfill the language requirements for a degree of Magister (Masters) in Business Administration. Subjects formed two groups by registering for two sections of a BWL III course they were required to take as part of the Business Administration Department's English language requirements. A coin toss determined which group would represent the experimental and control conditions.

SYLLABI: LEXICAL AND GRAMMATICAL OBJECTIVES

The control and both experimental conditions were presented with linguistic structures and tasks which required them to analyze a process and to report, in written and oral forms, the results of their analyses. Consistent with the nature and objectives of this business English course, many of these tasks required students to convey their analyses of business trends - for example, past operating performance and future prospects of specific companies or national economies. In addition to sharing the same objectives, the language component of the two classes employed the same notional/functional approach and used the same materials, although the experimental group was exposed to fewer language exercises. Because the control group was given additional notional/functional exercises, it, in effect, had additional practice with the target structures. The control group had sixteen hours of language work, while the experimental group spent 50% of the course hours learning a (meta)cognitive model for process analysis and 50% focusing on language training. The same teacher, the experimenter, taught all classes. Thus, the cognitive skills training module was the sole difference between the control and experimental groups.

The objective of both the control and experimental courses was to facilitate the learners' use of grammar and lexis common to the description of processes. The selection

of that grammar and lexis was guided by Trimble's (1985) perception of process description as an example of ESP rhetoric. According to Trimble, the rhetoric of "process description is characterized by the detailing of a series of steps, each but the first dependent on the previous step and all aimed at achieving a definite goal" (Trimble 1985, p. 20). Accordingly, the language selected as salient to the task of process description focuses on the functions of describing steps in a series: expressing sequence, depicting the logical relations between steps: expressing causality and result, and delineating the goal of the process: expressing purpose. Extrapolating these language functions from the task of process description would seem to have prima facie validity even if it weren't explicitly suggested by Trimble and others.

The enumeration of grammatical and lexical exponents consistent with these functions was more difficult. According to Van Ek and Alexander (1975), no empirically validated system yet exists for designating specific grammatical structures as exponents of a given function. Such selection must be guided by intuition and experience. Given the lack of definitive guidance, the selection of exponents for this project drew upon this researcher's "intuition and experience" as well as that of other EFL practitioners, including Van Ek and Alexander, Mary Todd Trimble and several colleagues at the University of Klagenfurt. Specific experience in the author's own case included two semesters of piloting the experimental materials before conducting the experiment. All of the exponents included figured prominently in the pilot courses and were found to be relevant for their respective functions. Thus, the items enumerated in Table 1 represent not only this researcher's insight, but grammar and lexis commonly presented in current texts (c.f., Trimble 1985; Brockman and Kagan 1985) as exponents of the functions outlined above.

Table 1: Process Language Functions and Exponents

EXPRESSING SEQUENCE

Discourse Markers	Grammatical Structures
1. ordinals	1. present perfect
2. after	2. present perfect continuous
3. already	3. simple past
4. during	4. past continuous
5. finally	5. used to
6. initially	6. past participle phrases
7. next	
8. then	
9. since	
10. subsequently	

EXPRESSING CAUSALITY AND RESULT

Discourse Markers	Grammatical Structures
1. accordingly	1. causative/permissive (made/let)
2. as a result	2. result clauses
3. because	3. gerunds after prepositions
4. consequently	4. modal perfects for guesses
5. since	
6. therefore	
7. thus	
8. if/unless	

DESCRIBING PURPOSE

Discourse Markers	Grammatical Structures
1. in order to	1. infinitive of purpose
	2. verb + infinitive
	3. real future condition
	4. be + supposed to

Given the time constraints of the course, the linguistic objectives for the experiment had to be limited. Accordingly, no claim is made that the inventory of grammatical and lexical features is exhaustive or even sufficient for complete mastery of the functions of which they are exponents. Rather, it is contended that these linguistic items facilitate the

expression of the corresponding functions and that these functions, in turn, facilitate process description.

MATERIALS AND PROCEDURES

The language teaching materials used with both groups were of two basic varieties: those designed to heighten learner awareness of the target structures in meaningful contexts and those designed to give learners practice using the structures for their own analyses. In the control group the target language structures were presented in the context of short written descriptions of business processes and practiced in activites such as intensive readings, writing exercises, pairwork, small group discussion, role plays, problem solving exercises, and short presentations. Thus, during the sixteen hours of the process description syllabus, the control subjects practiced using the target structures, received language feedback, and focused their efforts on the communicative notions and language exponents posited as constituents of process description. In contrast, the experimental subjects were encouraged to view each notion as being an integral part of a larger whole, the schema for process description.

The experimental group spent the first 8 hours of the process description module refining, retuning, and restructuring their general schema for process[2]. The first step in this operation was familiarizing them with the hierarchical structure of information. The materials and techniques used were based on Upton and Samson's (1961) graded exercises in analysis which present process as a structure changing over time for a purpose. A schematic representation was elaborated whereby any process could be analyzed in terms of its constituent parts (sequential *stages*, *junctures* between stages and causally related *phases*) and the relationships between those parts (the *purpose* of the process, the*function* of the phases, and the *ordering factors* which determine the placement of junctures). Experimental subjects practiced applying this mode of analysis to everyday activities (such

[2] Because "process" is such a ubiquitous phenomenon in human experience, it was assumed that the learners did have some mental representation for this concept.

as "getting dressed") and business operations (such as "setting up a factory" or "designing a marketing strategy"). During the schema induction module, care was taken to avoid explicit language teaching and to focus on the conceptual content.[3] The language teaching element of the process description syllabus occurred during the second eight hours of the module using roughly half of the language teaching materials employed with the control group.

STATISTICAL ANALYSES

Reliability of the test to assess learning was calculated using Cronbach's Alpha. An Analysis of Covariance (ANCOVA), with three factors (group, sex, and high school attended[4]) and one covariate (year of birth), was employed to establish the similarity of the control and experimental groups at the beginning of the experiment. ANCOVA was also utilized to separate the effects of the independent variable from those of the moderator variables (sex and school) and the covariate (year of birth), as well as to analyze the effects of the moderator variables and covariate on the dependent variables (net learning gain, improvement, and deterioration). Paired t-tests were used to compare student performance on pre-tests and post-tests.

The ages of students in all groups varied very little from a mean age of 21 years. Nonetheless, there was a significant correlation between year of birth and test scores in the experimental group ($F = 6.828$ / $p = .012$): younger subjects scored higher on the pre-test. No correlation was found for the control group. Given the relative uniformity of the subjects' ages and the fact that subjects were drawn from a relatively homogenous population, this correlation between year of birth and pre-test performance for one of the two groups is anomalous, and no plausible explanation can be offered at this point.

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[3] Needless to say, many of the descriptions and discussions of the processes treated in class entailed the use of process description exponents. However, minimal feedback was provided on usage.

[4] High school attended was controlled to detect any differences which might be attributed to the character of the participants' secondary education which varies widely in Austria. Sex was included to determine if sex differences affected participants' performance.

However, the influence of age on net learning gain, improvement, and deterioration will be addressed later in light of post-test results.

An analysis of covariance on the pre-test performance of both groups indicated that there was no significant difference in command of the target structures between the two groups ($F < 1$, $p=.703$). This provided the baseline data for a comparison of learning gains.

COMPARISON OF LEARNING

To assess the degree to which the target structures were learned, an analysis of covariance compared the mean learning gains of the experimental and control groups. The most important finding of the study is that the experimental group performed significantly better than the control on the measure of net learning gain, $F(1,52) =6.20$, $p<.02$. The results of paired t-tests illustrated that the net learning gain of subjects in each of the two groups. Scores of students in both groups reflected statistically significant learning gains ($p < .001$).

These findings support the hypothesis on which this study is based, that schema induction training facilitates greater acquisition of the target grammar and lexis than does conventional teaching practice. However, here is no significant difference ($F<1$) between groups when comparing pre-test and post-test performance on the measure of improvement (the sum of items answered incorrectly on the pre-test but correctly on the post-test). An understanding of why net gain correlates with group, but improvement does not requires a closer examination of the data for deterioration (the sum of items answered correctly on the pre-test but incorrectly on the post-test). Additional tests were conducted to examine the differences between learning gains and losses. The data indicate that experimental subjects deteriorated significantly less than the control subjects ($F=12.13$). The most theoretically consistent explanation for this are that the schematicization of the learners' content area

knowledge aided the retention of corresponding lingusitic knowledge. This interpretation will be addressed in the discussion section.

EFFECTS OF SEX, SCHOOL, AND YEAR OF BIRTH

Using the same ANCOVA design that was employed to establish the initial similarity of groups at the beginning of the experiment, the variables: *sex* and *school* and the co-variate: *year of birth* were examined for possible effects on the dependent variables: *gain, improvement,* and *deterioration*. There were no significant differences in performance between sexes or among graduates from various school types. However, there was a significant effect of year of birth on net gain and improvement, although correlations shown in Table 1 indicate that this effect only obtains for the experimental group. Specifically, the improvement of subjects in the experimental group positively correlated with their age: older students seemed to benefit more from the schema induction training module. The correlation of net gain, improvement and deterioration with year of birth are summarized below.

Table 2: Net Gain, Improvement, and Deterioration: Correlation with Year of Birth

		Net Gain		Improvement		Deterioration	
	n	r	p	r	p	r	p
Experimental	40	.48	.002	-.51	.001	-.09	.586
Control	15	-.02	.959	-.08	.788	-.13	.654

DISCUSSION

The finding that the difference in deterioration was statistically significant while the difference improvement was not suggests that the beneficial effect of schema induction training for language acquisition may lie in the capacity of this methodology to inhibit language loss. It suggests that schema training may help learners to consolidate previously

acquired language during the acquisition of new linguistic knowledge, or it may help students to develop conceptual - that is, schematic - strategies which encourage the classification of linguistic knowledge by conceptual categories which, in turn, facilitate the acquisition, storage, and retrieval of that knowledge in long-term memory. This and previous research suggest that schema theory offers important insights for the explication of second language learning. The objectives of the current discussion are to explain these findings in terms of previous schema-theoretic research, to point out ways in which the experimental design of the current study could be improved, and to examine concomitant questions which should be addressed if a schema theory of second language acquisition is to be more fully explored.

The most important second language acquisition finding in this study is that schema training facilitates the learning of grammar and lexis. This finding is not entirely surprising in view of the theories and previous studies cited throughout this paper. However, this may be the first study which has explicitly demonstrated a relationship between the teaching of a schematic representation of knowledge and the acquisition of the syntactic and lexical features of language.

Previous research suggests that the superior performance of the experimental subjects may be due to the greater acquisition and storage capacities of a hierarchically defined representation of knowledge. In this view the schematic representation of knowledge, as described by Piaget (1960), Minsky (1977), Shank and Abelson (1977) and others, acts as a cognitive superstructure designed to accommodate new information. Alternatively, this superior performance may be attributed to the experimental subjects' more "expert" application of schematic strategies (e.g., bottom-up and top-down schema instantiation, inferencing, and analogical schema formation).

The first of these is the more plausible of the two explanations. The power of teaching well-defined schemata for the purpose of improving second language learners' comprehension and recall of discourse has been well documented (Kintsch 1974, 1977;

Mandler and Johnson 1977; Adams and Collins 1979; Meyer and Freedle 1984; Carrell 1984a,b,c, 1985, 1987; and others). Moreover, the role of schemata in facilitating the acquisition of syntactic structures had been suggested by Seliger as early as 1975. From various perspectives each of these studies has demonstrated that knowledge acquisition and memory accessibility are enhanced by the schematic representation of knowledge.

The alternative explanation that the superior performance of the experimental subjects may have been due to the acquisition of expert procedures for abstracting and structuring the underlying principles of schemata may not be entirely without basis. This interpretation is consistent with the hypothesis put forward by Arbib, Conklin and Hill (1987) and Rumelhart and Norman (1981) that schemata are both data bases and programs. In fact, students were trained in such schematic strategies as bottom-up and top-down processing. However, two points mitigate against this explanation. First, the proceduralization of schematic processing strategies would likely take much longer than the approximately eight hours provided during the schema induction training module described in this paper. In addition, much of the schema identification and formulation had been done for the subjects. Students were not required to practice the "expertise" of constructing abstract representations of phenomena; rather, the schema for process was presented to them. Thus, it is unlikely that their greater learning gains are attributable to the application of "expert systems".

Both explanations, however, touch upon ways in which learning may be enhanced by schema induction training, and the second explanation might prove more appropriate in explaining similar results from a study of marginally different design or of longer duration. The purpose of choosing between these two explanations is not to rule out the possibility that the other is relevant. A choice is made to delimit the claims to be made on the basis of the experimental evidence, to be consistent with previous research, and to suggest that the scope for future research is quite extensive.

A final hypothesis for the superior performance of the experimental subjects concerns motivation. Parallels have been noted between cognitive and linguistic development suggesting that children are intrinsically motivated to acquire language as they develop concepts they want to communicate. At another level the same phenomenon may apply to second language acquisition (Curran 1976). For second language learners the degree of motivation for acquiring specific language may be related to the degree to which they have made explicit the notions to be expressed by those structures. To the extent that the experimental subjects had more clearly defined (i.e., explicit) representations of process, they may have been more motivated to acquire the grammar and lexis appropriate for describing this phenomenon.

A second important finding of the experiment described in this study is that the net learning gain of the experimental subjects may be attributed to a significantly reduced rate of language loss among the subjects exposed to the schema induction training. This finding may best be understood in light of the concept of "backsliding" raised in the second language acquisition literature by Adjemian (1976), Karmiloff-Smith (1986), Lightbown (1985), McLaughlin (1987), McLeod and McLaughlin (1986), and Selinker, Swain and Dumas (1975). The evidence of backsliding among students, particularly among control subjects, is consistent with the observations of most previous researchers. The reason for the experimental subjects' performance may be that schemata inhibit the loss of information by providing a more highly elaborated structure in which to store both new and previously acquired knowledge. Schemata may be seen as not only facilitating the acquisition of new knowledge, but as structuring information for greater retention and recall. In light of Adjemian's (1976) hypothesis that backsliding may result from learner strategies designed to ease the expression of complex semantic notions, the role of schemata in clarifying complex relationships offers a plausible explanation of how and why schema induction training might reduce this phenomenon.

Language loss may also be at least partially explained as a product of the restructuring of knowledge in learners' cognitive systems as they acquire new information. Restructuring occurs as the relationships between previously learned information change, a process by which some information may be lost or its relevance to a given task diminished. McLeod and McLaughlin (1986) give the example of learners who have mastered the components of a complex task, such as the various forms that comprise the passive construction in English, but who do not understand how the parts go together to make a whole. Restructuring takes place when the relationship between these individual forms becomes transparent. However, the realization that these forms go together in the passive construction may undermine other previously learned structures, for example, the use of the past participle as a verb complement. Lightbown also observed that new forms are not simply added to old forms. This is "because language is a complex hierarchical system whose components interact in non-linear ways" (1985, p.177). Schemata, by helping learners construct hierarchically organized representations of knowledge, may secure linguistic structures in memory when the process of restructuring takes place and may account for the lesser language loss of the experimental subjects in the present study.

IMPLICATIONS FOR LANGUAGE TEACHING

The approach taken in this study entailed identifying a general content schema which could be sufficiently delineated that it could represent real world phenomena and could be taught. This schema was related to language functions associated with the verbalization of the concept represented by the schema and was presented to students in a manner designed to induce or restructure the learner's mental representation of the inherent concepts. Schema presentation was followed by the teaching of the functions and exponents relevant for expressing the concepts comprising the schema. No claim is made here that this is the only, or even the best, method for implementing a schema induction

approach to second language syllabus design, but it offers a model which can and should be elaborated upon.

Based on the experimental results of the present research, schema induction training deserves wider application for at least two reasons. First, it seems to facilitate the acquisition of grammar and lexis, one of the most basic objectives of language pedagogy. In addition, anecdotal evidence suggests that the teaching of schemata helps to develop conceptualization and analytical skills[5]. To the extent that this is also a fundamental objective of language training, especially in academic contexts, the schema induction methodology may offer significant collateral educational benefits.

Almost all the authors cited in this paper agree that language competence is an "integrated skill" which includes cognitive dimensions (O'Malley and Chamot 1990; Sigott (1993). Wong-Fillmore (1984), Wong-Fillmore and Swain (1985), and O'Malley and Chamot (1990) have put forth strong arguments that the rate and level of second language acquisition are due to the involvement of general cognitive processes. A schema-theoretic approach offers a practical means of fostering the use of general cognitive skills in order to help learners apply a wider range of mental resources to the language learning task.

SUGGESTIONS FOR FUTURE RESEARCH

There are many questions that remain to be addressed by future research. This section will deal with several which relate to the design of the present study and those which address more general cognitive issues. These include problems related to the choice of: (A) the language functions and exponents; (B) the evaluative instrument; (C) the teaching methods and techniques; (D) the selection of schemata for teaching; (E) the notion of a common underlying conceptual proficiency across languages; and (F) the information

[5] Colleagues who taught subsequent language and business classes which included experimental subjects, control subjects and students who did not participate in the experiment remarked that the experimental subjects seemed to have noticeably superior process analysis skills.

processing transition between declarative and procedural knowledge. The following suggestion are made to address these issues.

Form-Function Relationships

Despite the precedents, problems remain with the selection of language functions and exponents. The difficulties of attributing language functions to the discussion of a given concept and of assigning specific exponents to the expression of an individual language function have been explored by Halliday (1973), Wilkins (1974), Van Ek and Alexander (1975) and others. Still, a principled approach to making choices of this nature remains to be identified.

The Language Test

Although the evaluative instrument used in the present experiment was found to be highly reliable, internally consistent and stabile, for measuring the aggregate learning gains of the subjects, better test construction would permit examination of individual test sub-sections (sequence, causality and purpose). Specifically, the test could be improved by including a sufficient number of test items for each of the sub-tests to ensure a reliable comparison of their results. An additional enhancement of the test instrument would entail the inclusion of items designed to elicit more constructed, rather than selected, answers.

A Schema Test

Finding or creating a test instrument which would measure the degree to which students acquired the target schemata would strengthen claims that the schema induction training was the operable variable which facilitated greater acquisition among the experimental subjects. Such a test would also provide valuable data for evaluating the ways in which schemata may be changed during the course of training and would allow more insightful judgments about whether schemata had been accreted, tuned, or restructured.

These insights, in turn, would provide feedback regarding the types and characteristics of schemata appropriate for pedagogical applications [6].

Teaching Methods and Procedures

Although the experimental module may have achieved some success in inducing the target schema in the learners' mental representations of phenomena, at times the materials proved difficult for students. Specific approaches to defining and elaborating learners' schemata have not received much attention in second language acquisition literature. Consequently, additional methods and techniques for the teaching of schemata should be explored.

Selection of Teachable Schemata

One of the most fundamental questions concerning the present approach is whether the schema induction method is a sufficiently generalizable method for language teaching. A general problem that may hinder attempts to expand a schema induction approach in second language teaching concerns the extent to which specific conceptual schemata can be identified, delineated, and taught. The schema for "process" has been treated extensively in pedagogical literature. Upton and Samson also suggest representations for "classification" and "structure", defining them in terms of "types" and "parts", respectively. These may, in fact, be good candidates for schema induction language training. However, a more extensive taxonomy requires further research into the criteria for determining whether a schematic characterization of a phenomenon can be delineated and taught. For example, Shank and Abelson's (1977) scripts may provide the basis for enumerating social interactions (small talk or negotiations) which can be represented schematically. Alternatively, Minsky's (1977) frame theory may provide the basis of descriptive strategies which could be represented as schemata. These constructs offer a starting point for the

[6] A method for assessing students' organization of concepts proposed by Naveh-Benjamin and Lin (1991) has been incorporated into a follow-up of the present study.

construction of a taxonomy of pedagogical schemata. Still, a methodical approach to such a task remains to be developed.

Proceduralization

The information processing transition from declarative to procedural knowledge needs to be examined with a study of longer duration to see if the stronger grasp of declarative knowledge exhibited by the experimental subjects at the end of the course enhances the development of procedural knowledge. Specifically, does schema induction training help in automaticizing the discourse rules of process description, thereby allowing greater short-term memory capacity to attend to other variables? Results from research on advanced learners who overlook function words as they attend to the task of reading a given passage suggest that it does (cf. Hatch, Polin and Part 1970; McLeod and McLaughlin 1986). To answer this question, control and experimental groups similar to those in the present study should be followed through a subsequent course of study, the objectives of which included fostering the skills of process description. The results of that study might confirm the importance of enhancing the declarative knowledge representation of learners before providing the more common language training designed to develop the procedural knowledge which underlies skill performance. An experiment of this kind and scope might also be designed to shed additional light on the two explanations for net learning gain discussed earlier.

Common Proficiency Across Languages

The cognitive approach to learning and knowledge representation may imply a universality of some types of knowledge. Cummins (1984) has suggested a common underlying cognitive representation of academic knowledge which is accessible to bilinguals in either of their languages. Might this common underlying knowledge extend beyond the realm of academic content to include such general concepts as process,

structure, classification, time and space order perception, analogy, exemplification, and illustration? Universality of these and/or other concepts would suggest that a schema induction approach might be useful not only in language teaching, but also in other fields, such as translation. Research should seek to identify semantic universals which would lend themselves to schema induction training in any language.

CONCLUSION

This study has outlined a new approach to the teaching of grammar and lexis built on the foundations of cognitive psychology, reading studies, and second language acquisition research. It has proposed, tested, and found satisfactory the hypothesis that the teaching of a conceptual schema facilitates the acquisition of grammar and vocabulary associated with verbalizing the relationships inherent in that schematic representation of knowledge. It has argued at least a prima facie case for the wider application of this methodology in language teaching, and it has suggested further research necessary for the construction of a schema-theoretic approach to language pedagogy.

Significant work is currently being done at integrating a cognitive dimension into the language learning curriculum, for example, the Cognitive Academic Language Learning Approach in use at Georgetown University. Although the schema induction method of teaching grammar and lexis has yet to be implemented outside the University of Klagenfurt and Eastern Michigan University, the results of the present study suggest that it merits wider application and scrutiny.

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