

MATCHING LEARNERS' COGNITIVE STYLE  
WITH SPECIFIC TEACHING METHODOLOGY : USING  
THE APTITUDE TREATMENT INTERACTION



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### ABSTRACT

The cognitive style of field-independence (the ability to identify a visual unit in a confusing background) has been shown in a number of studies to be related to success in second language classrooms.

This study hypothesized that field-independent learners will do better with the deductive method of teaching while field-dependent learners will do better with the inductive method of teaching. Eighty students belonging to two classes and about to take up English 101 Course were given the Group Embedded Figures Test to categorize them into field-independent and field-dependent learners. Then they were given a pre-test on grammatical points to be covered in the English 101 Course. One class of both types of field-independent/dependent learners was taught using the deductive method and the other class of both types of field-independent/dependent learners was taught using the inductive method. At the end of 10 lessons they were given the posttest.

Using SPSS, a 2x2 Factorial Analysis and Analysis of Covariance were performed. Results obtained showed that a significant relationship exists between learners' cognitive styles of field-independence/dependence and teaching methodology and learners' achievement. Both hypotheses

were supported. This study provides continuing evidence for the positive relationship between cognitive style of field-independence/dependence and learning of English as a second language. The study also recommends further replication of the study using larger samples of students from different language groups with varying ages and language proficiency levels.



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## CHAPTER 1

### INTRODUCTION

In the field of second language teaching, a subject of much inconclusive research has been which method of teaching facilitates learning most effectively. In spite of attempts to improve second language teaching the fact remains that some learners are more successful than others in acquiring a second language. Up till now no real superiority of one method over any other method has been clearly established. The successive trends in language teaching have been enthusiastically accepted at their introduction but lost favor when teachers realized that no one method seems to be successful for all students. It has been suggested that different methods require different cognitive processes. For example, the Grammar-Translation and Cognitive – Code Methods seem to require an analytical cognitive style, while the Direct and Audiolingual Methods seem to tap holistic thought-processing modes. It has also been suggested that individual students tend to prefer certain methods to other methods suited to their unique cognitive style of encoding, storing and retrieving information.

Earlier obsessions on the search for the perfect method are now being replaced by a general acceptance of eclecticism in language classroom practice. In an article entitled “There Is No Best Method - Why?”, Prabhu (1988) argues against the notion of “best method”, which implies that which would be superior to all would therefore be expected to benefit all learners. It is believed that such best method “would reduce teaching to a faithful following of a highly specified routine” instead of engaging what Prabhu calls “the teacher’s sense of plausibility—about how learning takes place and how teaching causes or supports it”, which implies a sense of involvement by the teacher thus elevating his role as a decision maker.

In learning and teaching, an important line of educational research is Aptitude Treatment Interaction (ATI) (Cronbach and Snow, 1977). ATI is the matching of specific learner characteristics to specific treatments to facilitate learning. The basic assumption is that any treatment or teaching method interacts differently with different individuals. Since learners differ, the search for generally superior methods should be supplemented by a search for ways to fit the teaching or treatment to each kind of learner. An interaction is said to be present when a situation has one effect on one

kind of person and a different effect on another. Moreover, questions about interactions need to be asked in connection with instruction or teaching. What characteristics make instructional situations “similar” in the sense that the situations all benefit the same kind of learners. And what variables define “similar” learners, i.e. those ready to profit more or less equally from the same kind of instruction?

The basic assumption in this study is that the treatment or method employed by the teacher interacts differently with individual learners of different cognitive styles. Based on the ATI paradigm, success in second language learning depends on the harmonious fit of learners, cognitive style and the kind of treatment in the classroom. It is believed, therefore, that there is no one best method for an individual learner but a best method based on his aptitude or cognitive style.

Cognitive style is the “relatively stable way individuals perceive, conceptualize and organize information” (Witkin, 1981). In other words, an individual examines components of a stimulus, to access information-processing strategies previously acquired and stored to reorganize or reassemble these experiences in order to discover a solution. Cognitive style research has provided evidence that two very distinct modes of

thought may exist in every individual. As an individual matures he or she tends to depend more on one mode of thought rather than the other for problem solving, and it seems that this preference may also be shaped and reinforced by the culture or society the individual lives in.

With the dramatic increase and broader scope of second language acquisition research, the language teaching profession has available to the language teacher explanatory models which do not only explain how second languages are acquired but also why they are and are not acquired, (Spolsky, 1990). To account for differential success in second language acquisition, greater interest has been directed to the learner variable including his cognitive style which is the main concern of this study.

In second language research, the most extensively investigated cognitive style is field-independence and field-dependence. Field-independence is the ability to identify a visual unit in a confusing background. Field-dependence is the difficulty or inability to identify a visual unit in a confusing background. According to Witkin (1977), field-independent individuals are more able to analyze a field and organize and impose structure on an unorganized field while field-dependent individuals have a functional fixedness in problem-solving, displaying less ability to

organize or impose structure on verbal and other materials. Field-independence was found to correlate significantly with language success at all proficiency levels in the Toronto Good Language Learner Study (Naiman et al, 1978), while field-dependence is associated with the logical - analytical thought - processing mode attributed to the left hemisphere of the brain. Field-dependent individuals may learn better in natural language settings while field-independent individuals are more successful in formal classroom settings. Field-independence and field-dependence are determined by the use of techniques such as the Group Embedded Figures Test (GEFT) (Witkin, 1977).

The characteristics of cognitive styles of field-independence/dependence specifically, the ability to organize and impose structure on an unorganized field, have found congruence with the AIT paradigm that successful second language learning may depend on the harmonious association of the learner's cognitive style with either the deductive or inductive method of teaching used in a particular language class. Much instructional theory and research has been concerned with learning "by discovery" or with guided discovery that leads the learner from specific examples or experiences to general principles. This inductive method

contrasts with the deductive method in which the teacher states the rule/principle and then gives examples or exercises to consolidate the learner's understanding of the principle. Field-independent learners' ability to analyze a field and organize and impose structure on an unorganized field is associated with the ability to learn better in a deductive fashion. Given this line of thought it seems reasonable, therefore, to assume that field-dependent learners do better in an learning environment where inductive method is employed by the teacher.

#### Objectives of the Study

This study aims to:

1. explore the possibility of categorizing second language learners according to their cognitive styles using the Group Embedded Figures Test.
2. further explore the possibility of matching second language learners' cognitive style with specific teaching methodology.
3. find out what type of second language teaching methodology is more effective for learners classified as field-independent.
4. find out what type of second language teaching methodology is more effective for learners classified as field-dependent.

5. obtain positive evidence of the relationship between learners' cognitive styles of field-independence/dependence and teaching methodology.

6. further advance the search for second language teaching methodologies which are more appropriate and effective for Thai learners.

### Hypotheses

From the foregoing discussion, the following hypotheses are formed:

1. Field-independent learners will obtain higher posttest scores than field-dependent learners after having been taught in the deductive methodology.

2. Field-dependent learners will obtain higher posttest scores than field-independent learners after having been taught in the inductive methodology.

### Significance of the Study

Generally this study will be regarded as part of the English language teaching profession's continuing search for the ultimate method of teaching effective communication in the second language classroom. In Thailand the opportunities to acquire English as a second or foreign language lie mostly in the classrooms. Although there are opportunities elsewhere, for

example, outside of the classroom, it is observed that Thai learners are reluctant and shy to practice English language skills for particular reasons. It is, therefore, very crucial to find out what teaching methods best suit different types of learners in classroom situations. It seeks to help answer the question : Why does one method sometimes work effectively and at other times poorly? or Why do some learners succeed and others fail even under the same conditions in learning a second language?

### Definition of Terms

1. Cognitive style : is the “relatively stable way individuals perceive, conceptualize and organize information” (Witkin et al 1977)
2. Field-independence : is the ability to identify a visual unit in a confusing background. (Witkin et al 1977)
3. Field-dependence : is the difficulty or inability to identify a visual unit in a confusing background. (Witkin et al 1977)
4. Teaching methodology : a way, technique, or approach to teaching a particular course of study
5. Deductive methodology : a teaching methodology whereby rules or generalizations are given followed by applications or examples of these rules and generalizations



6. Inductive methodology : a teaching methodology whereby examples and applications of rules are given followed by statement of rules and generalizations

7. Aptitude : is any characteristic of a person that forecasts his probability of success under a given treatment

### Limitations of the Study

#### Subjects

When the researcher made a proposal to conduct this research a few years ago, she planned to have subjects coming from four private universities namely ABAC, Bangkok University, Dhurakij Bandit University and the University of the Thai Chamber of Commerce. Two groups of forty students from each of these four universities would be used as subjects. However, this original plan did not materialize because the researcher encountered difficulty finding instructors, coordinators and subjects in the other three universities. This difficulty was due to the different English curricula, schedules, course descriptions and outlines. The researcher ended up with subjects coming only from Bangkok University.

The decrease in the number of subjects from three hundred twenty to eighty might somehow have affected the generalizability of the findings of this study.

### The Pre-Test and Post-Test

The grammar test was used as the only measure of second language proficiency. It could be argued that the higher post-test scores gained at the end of the deductive and inductive lessons might just be an artifact of test method (multiple choice) rather than evidence of association with language skills. Perhaps field-independence/dependence, the ability to perceive analytically, is associated with understanding language as a system, which was tested by the test content and the test method of the Multiple-Choice Grammar Test. As such, it is a discrete-point test reflecting a dated view of language proficiency. As measured by this type of test, the notion of English proficiency is, by design, limited in two ways. First, its setting is restricted to an academic environment and second, it tests receptive rather than productive skills. However, for purposes of student placement in different levels of proficiency and in decisions for admissions to university this type of test performs well.

## CHAPTER 2

### REVIEW OF RELATED LITERATURE

In this chapter, several related studies are presented. Discussion will proceed in this order: 1) information on matching aptitudes and treatments 2) studies on deductive/inductive treatments 3) earlier studies on cognitive styles of field-independence/dependent in general areas 4) studies on field-independence/dependence in relation to second-language learning.

The volume of research on learning, instruction, and individual differences is enormous but only limited progress has been made toward an integrated understanding of the nature of individual differences in ability to learn. Educators continually devise and apply new instructional treatments hoping for improved results. Intuitive adaptations guided by the teacher's experience and his impressions of each student take place continually in the classroom. Researchers have been formulating principles by which the adaptation of instruction can be made systematic and productive.

Aptitude Treatment Interaction (ATI) research has sought to establish generalizations relating treatment variables to measurable characteristics of the individual. Treatment variables and aptitudes are numerous, so the combinations to be tested are virtually inexhaustible.

Throughout the modern history of differential psychology, there has been a division between those who wish to concentrate on a few key dimensions of aptitude and those who emphasize how very many dimensions are required to characterize an individual fully. To some, it seems best to focus on a short list of especially significant traits for scientific purposes and also in any rule for assigning students to treatment or instructional groups.

### Matching Aptitudes and Treatments

Cronbach and Snow (1977) suggest that aptitudes and treatments can be matched in at least three ways: “capitalization of strengths,” “compensation,” and “remediation.” All of these tactics assume that ATI effects operate on the individual, ignoring social-psychological factors operating at the group level.

The first is called “capitalization” strategy because it tailors instruction to capabilities of the learner. Thus, some writers have suspected that learners high in spatial ability will do better when more diagrams are used in teaching. Likewise, a student high in verbal ability might be expected to respond best to a more verbal treatment.

One variant of the strategy is to capitalize on student preferences. Conceivably, a mode of instruction a learner is more comfortable with is

one to which he can and will respond well. Hence one might expect self-selection among materials, work schedule, etc., to be beneficial. Catering to preferences assumes that the learner has distinct preferences, that the learner really does know what treatments serve his purposes, and that the learner's goals are fully compatible with those of the instructor. In the few studies testing this strategy, the results indicate that basing instructional adaptations on student preferences does not improve learning and may be detrimental.

A second form of aptitude-treatment matching may be referred to as compensation. A treatment can be made to do for the learner what he cannot do for himself. If the usual treatment requires the learner to use some skill or mental process that is not inherent also in the criterion performance, it may be possible to add to the treatment a prosthetic substitute for the learner to use. If the learner is weak in organizing, it will help to organize the instructional material for him. The poor reader can listen to the material if it is put on tape. Those whose minds tend to wander can be given a text studded with questions to prompt attention. To give an example, perhaps the learner with low verbal ability is poor at formulating in words what he observes. It would then be reasonable for the treatment to

provide verbal statements for him. If he has high spatial ability he perhaps needs few diagrams, since he can visualize their extensions and transformations. The high-verbal learner who is weak in visualization might be supplied with extensive diagrams and left to generate his own verbal representation. Each treatment can be preprocessed by the needed “aptitude,” to compensate for a particular weakness.

A third form of aptitude-treatment matching is remediation. In its simplest variation, a remedial loop merely fills specific holes in the student’s initial knowledge. Where a general skill in learning is weak, it usually ought to be remedied rather than bypassed through a compensatory treatment. Thus one would help the poor reader to learn by training his reading.

The Aptitude Treatment Interaction paradigm with cognitive style as the aptitude variable and computer search tool type as the treatment was utilized by Leader and Klein (1996) in their study to investigate the effects of search tool and cognitive style on performance in hypermedia database searches. Subjects were 75 adult students enrolled in a pre-admission English as a second language program at a large southwestern university. The cognitive style variable had two factors: field-independence and field-

dependence. Search tool had four levels: browser, index/find, map, and all tools. The researchers assumed that the search tools would interact with the cognitive styles of the learners. Both field-independent and field-dependent learners were expected to be able to search the database with similar effectiveness in the browser, map and all tools treatment. However, the field-independent learners were expected to be more effective than the field-dependent learners at searching the database in the index/find treatment. The results revealed that there was an interaction between search tool and cognitive style.

#### Studies of Inductive/Deductive Treatments

Complex hypotheses regarding differential abilities guided a study by the Florida State group. The study crossed inductive/deductive with verbal/figural treatment (Kropp et al, 1967). Six aptitude measures were available, but three were not expected to interact with the inductive/deductive contrast. The content regarding mathematical sets, was taught to about 400 fifth-and sixth-graders, in a program requiring about 1½ hours. The deductive treatment explained concepts and then gave examples; the students were passive readers. The inductive method offered more examples, both positive and negative, but did not directly explain or define

concepts. Subjects were asked to think of further examples, but induction of a rule was not explicitly required. An immediate posttest contained verbal and figural items. The inductive aptitude measures were Figure Grouping and Work Grouping from PMA; an Inference test from CTMM was deductive. Treatment main effects were found negligible.

Tallmadge and his associates (Tallmadge & Shearer, 1969, 1971 : Beswick & Tallmadge, 1971) pursued a line of research that included the inductive/deductive contrast as one main treatment variable. The 1969 report covered two studies, each with different content (linear programming and aircraft recognition). Instruction was by guided inductive or deductive and rote. Lessons were presented to Navy trainees ( $N =$  about 115 for each course), in a one-day session with an immediate posttest. The aptitude measures included the Navy classification battery and 11 short special-ability test.

On the average, inductive instruction was superior for transportation problems and deductive instruction for aircraft recognition. Correlations of aptitude with achievement were calculated under each treatment; the difference of correlations between treatments was tested. Only three comparisons were significant, and these were trivial content contrasts



rather than method contrasts. One encompasses an ATI that may be important, however. In the highly mathematical course on linear programming, Arithmetic correlated higher with outcome from inductive rather than from deductive teaching. Several reasoning tests positively correlated with learning of this course under either treatment. Associative memory correlated with learning to recognize aircraft under either treatment.

Yabroff (1963) compared inductive/deductive forms of Programmed Instruction (PI) using 272 college students. The program, on statistical topics, had two versions within each treatment. In one, rules and examples alternated frequently (high alternation). In the other, all rules appeared at the start of the unit or at the end (low alternation). The treatment required only a single class period. The Miller Analogies Test was used to form high-and low-ability groups. 2x2x2 anova was performed on posttests of knowledge and problem-solving. The two methods were about equally effective overall. A three-way interaction, small in magnitude but significant, appeared on the time score of the problem-solving posttest. Lows solved problems more quickly after deductive, high-alternation PI. Highs finished the test faster after inductive high-alternation, or deductive

low-alternation, treatments. If the inductive treatment benefited anyone, it was the student with high ability. No ATI effects showed in the accuracy score, but one could be expected on a timed posttest. A significant ATI for errors on the program is to be ignored, as this intermediate variable was not operationally comparable from treatment to treatment.

The Yabroff materials and criterion measures were applied by Koran (1971) to 167 teacher-education students. Several aptitudes were measured. Only simple regression analyses were used, and correlations of aptitude measures with criterion measures were not reported. Of 12 *F* tests for ATI effects on the posttest, at least four were significant. As in the Yabroff study, time to solve criterion problems most often interacted. In general, it appears that good verbal comprehension and reasoning went with rapid work, to a greater degree in the inductive, high-alternation treatment. Aptitudes had little relation to speed of solving problems following any other treatment. The finding is roughly like that of Yabroff. The analysis and report shed no light on the possible differential relevance of the several aptitudes measured.

Hermann (1971) compared “ruleg” (rule-then-example) and “egrule” (example-then-rule) methods of PI. Fifth- and ninth-graders ( $N = 256$ ) were

divided for analysis into high IQ and average IQ groups (above and below IQ 110). Two learning tasks supposedly representing concept-learning and principle-learning were crossed with type of PI in a 2x2 design. The instruction was completed in a single session. Posttests four weeks later provided retention, near-transfer, and far-transfer scores. Each student also “relearned,” using the program variant he had worked from earlier, but the resulting time and error scores cannot be compared, as the groups were performing different tasks. Two significant ordinal ATIs were obtained for IQ, but with 84 statistical test.

Gagne’s instructional programs on number-series formulas were used by Becker (1967). Becker hypothesized that, among high-school students, those high on verbal tests and also low on mathematical reasoning would achieve better in the “deductive” treatment, while low-verbal, high-verbal, high-quantitative students would do better with “inductive.” His 68 subjects were selected to give additional representation to persons whose verbal and quantitative ranks differed markedly. An immediate achievement test and two transfer measures served as dependent variables. Although a pilot study had given seemingly significant support to the hypothesis, in the main study no ATI appeared. Both aptitudes were

positively related to achievement, regardless of instructional method.

Use of examples in exposition was examined in a study of mathematics instruction at the college level (Rector & Henderson, 1970). Each topic was taught by PI, in a pattern of characterization (C) plus exemplification (E). The duration of instruction was evidently brief. The treatments used various orders: CE/EC/ECE/C alone. Using SAT-M scores, 192 subjects were blocked for analysis of variance. An attempt was made to assess comprehension at three levels. The significance tests indicated no interactions ( $F$ 's near 1), but the test was of low power and the means for Highs and Lows hint at more interesting relations. The regressions were steep and nearly parallel for the posttest on higher processes (Level III). For Level II (application), the slope in C was very steep and that in ECE was comparatively shallow. The Lows did their best in ECE, which is just what was expected if extra examples help Lows to apply concepts. On the posttest of straight knowledge (Level I), the C treatment was much superior to the others, among both Highs and Lows. ECE had an exceptionally flat slope; i.e., the treatment was only a little inferior to C among Lows in the sample, but considerably inferior among Highs.

An unusual study by Grote (1960) gave evidence contradictory to that of many other inductive/deductive comparisons, but his instruction lasted only 39 minutes. Eighth-graders ( $N = 180$ ) were divided into threes on ability, then assigned to one of five conditions to learn physics. The instructional task had two parts, so Grote created two conditions of straight inductive/deductive instruction and two others that used both methods in opposite order. The fifth group served as control. Outcome measures represented immediate learning on each part of the task, and retention and transfer one and six weeks, respectively. Retention was greatest from the deductive treatment and transfer best from the mixed approach with inductive first. The analysis showed strong main effects for aptitude and disordinal ATI. On retention scores, deductive instruction was clearly best among Highs. Inductive yielded scores among Lows slightly better than those obtained in the deductive treatment. The transfer measure gave ordinal patterns; the order inductive-then-deductive was particularly helpful to Lows.

The inductive method gave comparatively poor results and no interaction with ability in a short study by Nelson and Frayer (1972).

Seventh-graders ( $N = 228$ ) studied simple geometric concepts. Groups were given posttests at different times so that the  $N$  for any one regression line was about 30. The regressions of immediate and delayed outcomes onto an arithmetic pretest were approximately parallel. The inductive group did somewhat less well than the deductive group even though they spent three times as long in study. This investigation was a nearly exact replication of an earlier investigation by Scott (1970) with 256 sixth-graders, which also found no interaction.

#### Studies on Cognitive Style in Education

Second Language Acquisition (SLA) Theory proposes that good guessers are good learners but essentially this proposal is an intuitive hypothesis, lacking empirical investigation. Characteristics of the learner are considered to play a role in SLA variation. Work in this area has been grouped as “The Good Language Learner Studies”. These studies ask the question: Since intelligence is not the factor that determines successful language learning what other factor explains an individual’s language learning abilities? A learning factor which has received consideration by researchers is “cognitive style.” Cognitive style is a psychological term used to describe individual differences in the way one habitually tends to

perceive, organize, analyze or recall information and experience. The concepts and methods derived from work on cognitive styles over the past three and a half decades are being applied at an ever increasing rate to research on problems of education.

In a paper written by Witkin et al (1977) they give these essential characteristics of cognitive styles in general. First, cognitive styles are concerned with the form rather than the content of cognitive activity. Cognitive styles refer to individual differences in how people perceive, think, solve problems, learn, relate to others, etc. The definition of cognitive styles is thus cast in process terms. This feature is a natural consequence of the origin of cognitive-style dimensions in laboratory studies where process is the central issue. As progress is made toward more precise specification of these processes, suggestions are emerging for ways of teaching students to use problem-solving strategies most appropriate to their styles, and even to shift to strategies more suitable for the task at hand than their preferred strategies. Second, cognitive style is a feature of personality and not alone of cognition in the narrow sense. This means that an individual likes to be among people, is particularly attentive to what others say and do, and takes account of information from others in

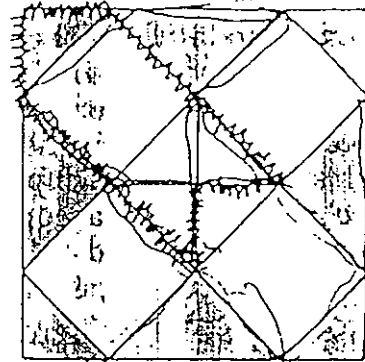
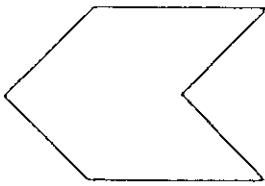
defining his own beliefs and sentiments. Third, cognitive styles are stable over time but this does not imply that they are unchangeable; indeed, some may easily be altered. In the normal course of events, it can be predicted with some accuracy that a person who has a particular style one day will have the same style the next day, month, and perhaps even years later. Fourth, with regard to value judgements, cognitive styles are bipolar. This characteristic is important in distinguishing cognitive styles from intelligence and other ability dimensions. To have more of an ability is better than to have less of it. With cognitive styles, however, each pole has adaptive value under specified circumstances, and so may be judged positively in relation to those circumstances. It is this bipolarity of cognitive styles which makes it less threatening and easier to communicate information about an individual's cognitive style directly to him than it is to convey some kind of information about his abilities, as, for example, telling him he has a low Intelligence Quotient (IQ).

The study of cognitive styles began in the 1940's in an effort to understand individual difference in terms other than intelligence. Among the cognitive styles identified to date, the field-independence/dependence dimension has been the most extensively studied and has had the widest



application to educational problems. According to Witkin et al (1974) there are now available simple devices and even group tests of field-independence/dependence for the entire age span and have been shown to have good reliability. One is the Group Embedded Figures Test developed by Witkin, et al (1971). This is a three section, pencil and paper test. The first section is for practice and is two minutes long. The second and third sections consist of nine items each and are both five minutes long. The task is to outline a geometric figure which is embedded in a larger, more complex design. The score is the number of correct answers, ranging from a zero to eighteen. A high score indicates field-independence and a low score, field-dependence.

Part of the early work on field-independence/dependence done by Witkin et al (1977) made use of an embedded-figures situation, in which the subject is shown the simple figure on the left. It is then removed and he is shown the complex figure on the right, with the directive to locate the simple figure within it. (See Page 26)



Individual differences in performance are very marked. For people at one extreme the sought-after simple figure quickly emerges from the complex design, whereas the people at the other extreme are not able to identify the simple figure in the time allowed for search. Witkin et al (1977) explained that the common denominator underlying individual differences in performance in the task mentioned above as well as tasks in their previous studies is the extent to which a person perceives part of a field as discrete from the surrounding field as a whole rather than embedded in the field or the extent to which the organization of the prevailing field determines perception of its components. The designation “field-dependent” was given to a person whose mode of perception is strongly dominated by the prevailing field and at the other extreme, where the person experiences items as more or less separate from the surrounding field the designation “field independent” was used. Witkin et al suggest that because scores

from any test of field-independence/dependence form a continuous distribution, these labels reflect a tendency in varying degrees of strength toward one mode of perception or the other. There is no implication that there exist two distinct types of human beings.

People are likely to be quite stable in their preferred mode of perceiving even over many years (Bauman, 1951). Furthermore, in western societies there are small but persistent sex differences in field-independence/dependence beginning in adolescence. Women, on the average, tend to be more field-dependent than men. The difference in means between the sexes is quite small compared to the range of scores within each sex. Evidence from cross-cultural studies that sex differences in field-independence/dependence may be uncommon in mobile hunting societies and prevalent in societies which are characteristically different in sex-role training and in the value attached to women's roles in the economy point out the important role of socialization in the development of sex differences in field-independence/dependence (Witkin & Berry, 1975). Extensive evidence accumulated over the years shows that the cognitive styles first identified by Witkin et al (1975) in perception manifest themselves as well when the person is dealing with symbolic

representations as in thinking and problem solving. The individual, who, in perception, cannot keep an item separate from the surrounding field, in other words, who is relatively field-dependent is likely to have difficulty with that class of problems where the solution depends on taking some critical element out of the context in which it is presented and restructuring the problem material so that the item can be then used in a different context.

A research done by Nebelkopf & Dreyer (1970) further enlarged the scope of this field-independence/dependence dimension of cognition. As seen in earlier studies a relatively field-independent person is likely to overcome the organization of the field, or to restructure it, when presented with a field having a dominant organization, whereas the relatively field-dependent person tends to adhere to the organization of the field as given. This characteristic difference in the manner of approaching the field lacks inherent organization.

This propensity toward imposing structure when it is lacking is not limited to perceptual materials such as ambiguous stimuli. It has been found in studies with verbal materials as well. In the study by Stasz (1974), for example, structuring of curricular content by field-independent

and field-dependent high school teachers and their students was examined in a social studies minicourse. In the area of social studies content structure is not very clear leaving the organization of concepts to the individual. In the study, psychological structuring was inferred from subjects' ratings of similarity among 10 general anthropological concepts such as "culture", "society" and "civilization". Both before and after minicourse instruction field-dependent teachers and students made fewer distinctions among concepts. For field-dependent teachers and students, concepts clustered into a large loosely organized group which included most of the concepts. For field-independent teachers and students, concepts clustered into small tight groups with less overlap across groups.

Witkin (1974) points out that evidence linking structuring tendencies to analytical tendencies of the kind involved in field-dependence/independence suggests that the individual differences might best be conceived as an articulated-global continuum. Analyses and structuring are complementary aspects of articulation. The person who experiences in an articulated fashion tends to perceive items as discrete from the background, when the field is organized, and to impose structure on a field and so perceive it as organized, when the field has relatively little inherent

structure. In contrast, that experience is more global when it accords with the overall character of the prevailing field as given, and involves less intervention of mediators such as analysis and structuring. The articulated-global concept is applicable to the processing of information both from an immediately present stimulus configuration as in perception or from symbolic material as in intellectual functioning.

From this evidence Witkin et al (1974) assert that they were dealing with a broad dimension of individual difference that extends across both perceptual and intellectual activities. Because what is at issue is the characteristic approach the person brings with him to a wide range of situations, they called it his "style" and because the approach encompasses both his perceptual and intellectual activities, they spoke of it as his "cognitive style". Relatively, field-independent and field-dependent persons should not be seen as appreciably different in sheer learning ability or memory. They should, however, be seen as reflecting differences in what is relevant, attended to, and salient.

One study which examined the role of cognitive style in learning social material was done by Ruble and Nakamura (1972). The children who were subjects in the study were given three concept-attainment

problems. On each trial of each problem their task was to identify the correct figure among three shown to them. In the first problem, “large size” was correct, but the experimenter provided an additional redundant cue, social in nature, by looking at the figure which was correct. In the second problem, the social cue alone was relevant and in the third problem, size alone was the correct cue. The field-dependent children showed better learning than field-independent children on the second problem, which featured the social cue alone. On the other hand, the field-independent children showed better learning on the third problem, which did not involve social cues at all. This pattern of findings makes it evident that field-dependent children were better at picking up social cues provided by the adult experimenter and using these cues in learning. Findings in other studies of a similar nature suggest that field-dependent persons are better at remembering social material and that this superiority is based on their selective attention to social material.

In the cognitive realm, persons with an articulated cognitive style are likely to analyze a field when the field is organized, and to impose structure on a field when the field lacks organization of its own. Persons with a global style are more likely to go along with the field “as is,” without using

such mediational processes as analyzing and structuring. In many situations field-independent people tend to behave as if governed by general principles which they have actively abstracted from their experiences. Depending on the situation they find themselves in, these abstractions may be correct or incorrect, useful or useless, but the performance of people to whom they are available may be understood in terms of the operation of such mediating concepts. In contrast, for field-dependent people information-processing systems seem to make less use of such mediators.

The principle that field-independent people more often make use of mediators is illustrated by studies of organizational factors in learning. Frequently in learning, the material to be learned lacks clear inherent structure, creating the requirement that the learner himself provide organization as an aid to learning. Field-dependent persons are likely to have greater difficulty in learning such material compared to field-independent persons who are more likely themselves to provide the mediating structural rules that are needed to facilitate learning. On the other hand, when the material to be learned is presented in an already organized form, so that structuring is not particularly called for, field-



dependent and field-independent people are not likely to differ in their learning.

In one early study done by Fleming (1968), a list of words was shown to field-dependent and field-independent subjects and free recall of the words subsequently measured. A novel feature of the study was that the words belonged to a hierarchical structure and were presented to the subjects in either a superordinate to subordinate sequence (e.g., animal, vertebrate, man) or vice versa (e.g., man, vertebrate, animal). When the superordinate items came first, the word set was given an inherent organization from the beginning. This advance organizational aid to learning was missing, however, in the subordinate to superordinate sequence. It might be expected, therefore, that the subordinate to superordinate sequence would be particularly difficult for field-dependent people. This proved to be true. Fleming's field-dependent subjects recalled fewer words than his field-independent subjects when this sequence was used. In contrast, no significant relationship was found between field-dependence/independence and word recall with the structured, superordinate to subordinate sequence.

In another study Koran et al (1971) examined the acquisition of a teaching skill from written and video-modeling procedures. These two treatments were found to be differentially effective for relatively field-dependent and field-independent intern teachers. Field-dependent teachers were found to benefit more from the video modeling than field-independent teachers who did as well in the written as with the video modeling.

Schwen's study (1970) used programmed instruction sequences varying in the amount of structure provided by the programmed text. The number of generalizations and examples given before an active response required by the learner was varied. In one (large-step) version of the text, all of the generalizations of an "imaginary" science were presented first with examples and discussion and then the learner was asked to answer questions and to solve some problems with corrective review if he responded incorrectly. In the second (small-step) version, each generalization was presented individually with examples and discussion and the learner answered questions with corrective review after each section before proceeding to the next one. In this way, the second version broke the learning sequence down so that each learning block covered one generalization at a time, while the first version left the learner to monitor

his own learning of the material before the final test. In the small-step program condition there was no relation between field-dependence/independence and retention three weeks later. However, in the large-step program conditions greater field-independence was associated with greater retention.

There is still another line of evidence which shows that field-independent persons are more likely to use mediators, of their own design in dealing with a learning task, whereas field-dependent persons are more likely to rely on characteristics of the learning task itself. This evidence comes from studies of concept attainment. Two main kinds of theoretical models have been traditionally used to describe the process of concept attainment. One model assigns an active role to the learner; the learner forms a hypothesis as to what the concept may be and he then tests the hypothesis by applying it to examples of the concept class. If the hypothesis is found wanting a new hypothesis is formulated following some strategy of search for the correct concept. In this view, the hypothesis formulated by the learner and the rules which govern the sequence of hypotheses he adopts are both regarded as learning mediators. The hypothesis-testing model of concept attainment has been intensively

studied by Bruner, Goodnow, and Austin (1956) among many others. In the second model of concept attainment the learner is conceived to have a more passive or spectator role. As each new example of a concept is encountered the constant relevant features of the concept class gradually emerge and the more variable irrelevant features of the examples wash out (Woodworth, 1938). This view of concept attainment postulates the use of neither mediating hypotheses nor hypotheses-testing strategies.

If the use of mediators is indeed more characteristic of field-independent than field-dependent people, we would expect that the former would attempt to use a hypothesis-testing approach and the latter a spectator approach to concept attainment. The results of a study by Nebelkopf and Dreyer (1973) provide support for this expectation. These investigators studied the shape of learning curves of field-dependent and field-independent subjects in a concept-attainment task. Their field-independent subjects showed no significant change in accuracy from trial to trial for a period of time, but then a sudden improvement in performance occurred as the criterion was achieved. Such discontinuity suggests the use of a hypothesis-testing approach. While incorrect hypotheses are being considered and discarded there is no improvement in performance; at the

point where the correct hypothesis occurs improvement takes place. In contrast, the learning curves for field-dependent subjects showed gradual improvement in performance from trial to trial. It is an outcome to be expected from the use of a spectator approach to the concept-attainment task.

It is important to point out that effective learning may take place by either a hypothesis-testing or a spectator approach. Thus, in the data of Nebelkopf and Dreyer there was no significant difference between field-dependent and field-independent subjects in number of trials required to attain the correct concept. Here, as in many other circumstances, field-dependence/independence appears to be more related to the “how” than to the “how much” of cognitive functioning.

It is also important to emphasize that the tendency of field-dependent persons to favor a spectator over a hypothesis-testing approach is found under conditions where both options are available. In most concept-attainment studies, however, the subject is implicitly directed to a hypothesis-testing approach. This is done, for example, by giving the subject a set of hypotheses from which the concept is to be drawn or by asking the subject to attempt to identify the concept after each trial. When

encouraged by these methods to learn concepts through a hypothesis-testing approach, field-dependent subjects are able to do so. However, when they do use a hypothesis-testing approach they seem to form hypotheses on a different basis than do field-independent persons.

The evidence above suggests that their lesser use of structuring as a mediator may handicap field-dependent students in unstructured learning situations. There are probably many classroom situations where, because the material to be learned is not clearly organized, the field-dependent student may be at a disadvantage. Field-dependent students may need more explicit instruction in problem-solving strategies or more exact definition of performance outcomes than field-independent students, who may even perform better when allowed to develop their own strategies. Attention to cognitive-style differences in learning under more structured and less structured conditions and detailed analysis of the problem-solving skills and strategies assumed for different learning tasks are necessary.

It has been observed that cognitive styles tend to be stable over time. However, many behaviors that emanate from cognitive styles are far more malleable. Although field-dependent persons tend to favor a spectator approach to concept attainment and field-independent persons a

hypothesis-testing approach, it seems easily possible to induce field-dependent persons to use a hypothesis-testing approach by as simple a means as providing directions to use such an approach. It has also been seen that when using a hypothesis-testing approach field-dependent persons may be more strongly guided by salient features of the stimulus array than field-independent persons, who sample the array more extensively. Here again there is some suggestion, though hardly yet proof, that field-dependent persons may be helped in overcoming their tendency to adhere to what is salient.

The case seems well documented that relatively field-dependent and field-independent persons tend to favor different learning approaches. The approaches favored by the one kind of person do not necessarily make for better achievement than the approaches favored by the other kind. Whether one approach will lead to a better learning outcome than others seems to depend rather on the specific characteristics of the learning tasks and the particular circumstances under which learning takes place. It is not unreasonable to expect that as teachers become more aware of the ways in which relatively field-dependent and field-independent students learn concepts, they may become more effective in adapting instructional

procedures to the needs of these different kinds of students. Beyond encouraging teachers to adapt their teaching to students as they find them, it may be hoped even more that teachers may find ways of helping student diversify their learning strategies. The apparent malleability of learning strategies flowing from cognitive styles gives some encouragement to this hope.

Research on the role of teachers' cognitive styles in their approach to teaching has, for the most part, used the social versus impersonal orientation and sense of separate identity aspects of the articulated-global dimension as points of departure for investigating classroom behavior of teachers with contrasting styles. The characteristics relevant to the teaching situation which stem from a more social or more impersonal orientation include extent of interest in interaction with others and in more social or more abstract curriculum content. The characteristic most relevant to teaching which stems from sense of separate identity is the extent to which the teacher is likely to assume responsibility for directing the teaching situation or to share this responsibility with students. Studies of teachers' preferences and of teachers' behavior in simulated teaching situations provide evidence of the expected differences in these



characteristics between more field-dependent and field-independent teachers.

This evidence indicates, first of all, that whereas relatively field-dependent teachers favor teaching situations that allow interaction with students, more field-independent teachers prefer teaching situations that are impersonal in nature and oriented toward the more cognitive aspects of teaching. As one finding, class discussion has been judged by more field-dependent teachers to represent better teaching and to be more effective for learning. A discussion approach, it should be noted, not only emphasizes social interaction, but it also gives the students more of a role in structuring the classroom situation. Wu (1968), for example, found that more field-dependent student teachers in social studies ranked discussion as more important to the practice of good teaching than either lecture or discovery approaches which were favored by more field-independent teachers. Both lecture and discovery approaches reserve to the teacher much of the organization of the learning situation either through facilitating and guiding student learning or through providing information.

Results from a study by Moore (1973) of patterns of verbal teaching behavior may perhaps also be seen as bearing on the issue of teacher

directiveness. Moore used a simulation game devised to investigate differences in teachers' use of rules, relations and examples in explaining chemistry subject matter and questioning students on the content. The results suggest that the more field-independent teachers tended to use questions as instructional tools more frequently than the field-dependent teachers. Field-independent teachers tended to use questions in introducing topics and following student answers, whereas the more field-dependent teachers used questions primarily to check on student learning following instruction. Since verbal intervention was restricted and student responses very limited discovery or discussion techniques could not be employed by the teachers. The kind of questioning approach used by the more field-independent group may be seen as the main avenue for teachers to attempt translation of a discovery approach within the context of the game.

#### Studies on Cognitive Style Related to Second Language Learning

The possible relevance of cognitive styles to second language learning was suggested in the early 1970's (Brown 1973). Since then a number of scholars have investigated the issue, primarily examining field-independence/dependence (Tucker et al, 1976, Bialystok and Frohlich 1977, 1978, Naiman et al, 1978). These several studies all researched

field-independence/dependence as a cognitive disembedding ability which might affect the second language performance of secondary school students studying French as a Second language (FSL) in Canada.

Results of the project conducted by Naiman et al (1978) indicated that field-independent and field-dependent students appeared to process and produce linguistic structures in different ways. This group also found that greater field-independence was significantly related to better performance on imitation and listening comprehension tasks especially at the more advanced stages of French study.

Tucker et al (1976) did not find this same relationship for younger students on listening comprehension, reading comprehension, or oral production tasks. However, this investigation did link greater field-independence to better performance on an achievement test of general language skills. By contrast, the findings of Bialystok and Frohlich (1977, 1978) attributed a very minor role in second language learning to field-independence. These investigators concluded that field-independence/dependence was not strongly predictive of success on the second language reading, listening, and writing tasks which they had selected.

Hansen and Stansfield (1981) hypothesized in their study that field-independence would be related to the acquisition of linguistic competence and that field-dependence would be related to communicative competence. They administered the Group Embedded Figures Test of field-dependence/independence to approximately 300 students enrolled in a first semester college Spanish class. The scores were then correlated with scores on tests of linguistic, communicative, and integrative competence. Student sex and scholastic aptitude were included in the design as moderator variables. The results indicated that field-independence plays a role in second language learning. This role was particularly noticeable in the acquisition of linguistic and integrative competence.

A study to investigate the relationship between two learner characteristics (field-independence/dependence and tolerance of ambiguity) and aptitude for second language acquisition used 61 adult international students enrolled in the Intensive English Institute at the University of Illinois. Chappelle and Roberts (1984) found that results in their study indicate that ambiguity tolerance and field-independence should be considered components of second language aptitude. Thus, a good language learner may be one who is, among other things, field-independent

and tolerant of ambiguity. Furthermore, these results provide evidence using non-English speakers in a second language environment thereby confirming and expanding hypotheses that have been previously supported using native English speakers in a foreign language environment.

Hansen (1984) analyzed the relationship between field-independence and cloze test performance for 286 subjects between the ages of 15 and 19 in six Pacific island cultures. Hawaiian students were found to be significantly more field-independent than Samoan, Tongan, Fijian, Indian-Fijian, and Tahitian students. In the South Pacific samples, males were significantly more field-independent than females, whereas in Hawaii there was no statistically significant relationship between sex and cognitive style. When the sample was taken as a whole a significant relationship was found between field-dependence/independence and cloze scores. Sizable group differences for subgroups within the sample, however, indicate that the relationship may not be significant for all cultures. Within cultures the subgroups having lower scholastic achievement showed a significant relationship between cognitive style and cloze test score, while the high achievers did not.

Two second language researchers, Stansfield and Hansen, (1984) examined particular learner traits such as cognitive style to ascertain their relationship to progress in learning another language. Their study explored the influence of one learner characteristic, field-dependence/independence cognitive style, on second language test performance especially as it relates to performance on the integrative type of measure known as the cloze test.

Approximately 250 American college students enrolled in a first semester Spanish course formed the sample group for this correlational study. Students were administered the Group Embedded Figures Test of field-dependence/independence along with several measures of linguistic, communicative and integrative competence. The results showed student field-independence to be related consistently in a positive fashion to second language test performance.

One other study relating cognitive styles to success in second language acquisition was done by Jamieson (1992). Forty six adult second language learners grouped into three classes in an academically oriented intensive English program in the United States were used as subjects. They were required to take the TOEFL which was administered to the entire group at the end of the second week of instruction. Cognitive style

measures were administered two to three weeks later. The TOEFL was administered again at the end of the semester. Overall the study provides continuing evidence for the positive relationship between field-independence and English as a second language proficiency.

Recent studies on cognitive style are concerned with determining the congruence of field-independence/dependence on specific types of classroom treatment. Using the Aptitude Treatment Interaction (ATI) paradigm, Harnett (1985) showed that UCLA students who were successful in the deductive method of teaching Spanish demonstrated field-independence while those who succeeded in the inductive method demonstrated field-dependence. This finding was confirmed by Abraham (1985) who devised two computer-assisted language lessons on participle formations: one, based on the traditional deductive method and the other on the inductive-example method. The pre-test and posttest scores of the subjects consisting 61 international students showed that field-independent subjects performed better on the deductive lesson while the field-dependent subjects did better on the inductive lesson.

The last three studies presented in this review of related literature provided impetus to the researcher to conduct a study using Thai college

students learning English as a second language as subjects since in most of the studies cited subjects were either American students learning Spanish as a second/foreign language or international students learning English as a second language.

To recapitulate, within the area of learning theory there has been a trend toward greater emphasis on the active role of the individual in the process of acquisition, storage and retrieval of information. This emphasis laid the basis for the study of individual differences in learning and memory by making it easy to regard these differences as expressions of broader dimensions of cognition. According to the concept of cognitive style, it is not that one person is better or worse than the other; both are equally good. It is more that they are different. Field-dependent subjects learn material with social content better than field-independent subjects. Field-dependent learners are more positively influenced by their teachers. Field-dependent learners perform better on structured tasks than unstructured tasks. Field-independents impose structure on unstructured material. Field-independents do better without teacher interference. The analytical field-independent person might be good at learning activities such as finding patterns, organizing data and learning rules. In Thailand,



English language rules are typically taught and practised in a classroom setting. With studies suggesting that field-independent students are more adept at learning and using rules than field-dependent students, the question thus arises as to whether a treatment or a method of teaching that does not emphasize rules might be more beneficial for field-dependent students. If so, teaching methodology could be individualized to accommodate students who differ along this continuum of cognitive style.

This research posed these hypotheses:

1. Field-independent learners will obtain higher posttest scores than field-dependent learners after having been taught in the deductive methodology.
2. Field-dependent learners will obtain higher posttest scores than field-independent learners after having been taught in the inductive methodology.

## CHAPTER 3

### METHODOLOGY

In this chapter, the subjects of the research, the lessons used, the test instrument, the procedures, data treatment as well as data analysis are explained.

#### Subjects.

The subjects of this study were eighty First-Year students who were about to start taking up their first year English 101 Course. They were part of the new intake of students who had passed the University Entrance Examination at Bangkok University. Forty of these eighty students belonged to one class group from the School of Accounting and the other forty belonged to another class group from the School of Communication Arts. Their common qualification was their having passed the entrance examination and were assigned to form class groups in their respective schools/faculties. It was assumed that students at this level have an intermediate level of English proficiency. At this level and during this period of time in their program of study, therefore, there was less probability for the subjects to have acquired earlier mastery of the grammar lessons.

These two class groups were taught by the same teacher who was instructed to use the Deductive Method for one group and the Inductive Method for the other group. Neither she nor the students were informed about the research purposes or objectives.

### The Lessons.

The lessons used for this study were grammar lessons normally covered in the English 101 Course Outline. The lessons were taught using the deductive method for one class and inductive method for the other class. Grammatical points covered included concepts on articles, nouns, pronouns, verb tenses, and adverbs.

### Teaching Procedure In The Deductive Methodology

1. Review of previous lesson
2. Motivation for new lesson
3. Introduction of new lesson
4. Explanation of grammatical concepts and structures to be learned
5. Explanation of grammatical rules and generalizations on the concepts presented in No. 4
6. Application of grammatical rules by giving as many examples as possible

7. Check-up
8. Homework (further application of rules learned for mastery)

### Teaching Procedure In The Inductive Methodology

1. Review of previous lesson
2. Motivation for new lesson
3. Introduction of new lesson
4. Explanation of grammatical concepts and structures to be learned
5. Giving of examples of the grammatical concepts and structures presented in No. 4
6. Formation of grammatical rules and generalizations based on structures presented in NO. 4.
7. Check-up
8. Home work (further application exercises for mastery)

### The Test Instrument

The same grammar test was used for pre-testing and post-testing. Extra care and caution had been applied in constructing the grammar test. To ensure that the test had content validity, the contents or grammatical concepts covered in the test were the same grammatical concepts taught in the language classroom. To put it simply, “what was tested was what was

taught.” The test was constructed in a format similar to a standardized English Grammar Test such as that of Oxford’s, particularly “A” level and “O” level. Moreover, an earlier item analysis of this particular test in the study revealed a similarity to the items tested in language achievement tests prevalently used in many schools.

### Procedures

Before any formal teaching was done the Group Embedded Figures Test developed by Witkin et al (1971) was administered to students of the two class groups numbering forty each and a total of eighty students. The GEFT developed by Witkin, et al was chosen as the measure of field-independence/dependence. This is a three section, pencil and paper test. The first section is for practice and is two minutes long. The second and third sections consist of nine items each and are both five minutes long. The task is to outline a geometric figure which is embedded in a larger, more complex design. The score is the number of correct answers, ranging from a zero to eighteen. A high score indicates field-independence, a low score, field-dependence. In the first class group of forty students (Numbers 1-40) twenty-one were classified as field-independent and

nineteen were classified as field-dependent. In the other class group of forty students (Numbers 41-80) twenty-four were classified as field-independent and 16 were classified as field-dependent. A pre-test consisting 100 points of Multiple-Choice Grammar questions was administered to students of both class groups. The test items covered the grammatical points or structures to be taught. The test was pilot-tested two weeks earlier to a group of twenty students from another school. This same test was used for post-testing or after teaching both classes using teaching methodologies. Class group A (Students 1-40) were taught ten grammar lessons using the Deductive Method while Class Group B (students 41-80) were taught the same ten grammar lessons using the Inductive Method. Note that in each of these two class groups there are both field-independent and field-dependent students. At the end of the ten grammar sessions a posttest (same as that given for the pre-test) was administered to seventy-seven students. Three students from the original eighty were absent.

### Data Treatment

In this study there were two independent variables: Cognitive style of field-independence/dependence and Deductive/Inductive teaching methodology. The dependent variable was the posttest score and the

pretest was the covariate. The learners' pre-test scores and posttest scores were compared to find the main effects of cognitive styles and the interaction between the cognitive styles of field-independence/dependence and teaching methodology.

### Data Analysis

The collected data were analyzed using SPSS/WINDOW 7.5 (Statistical Package for Social Sciences). A 2x2 Factorial Analysis and Analysis of Covariance were performed. The acceptable statistical significance level was set at alpha ( $\alpha$ )  $\leq$  0.05.

To analyze Hypothesis One and Two, the 2x2 Factorial Analysis was conducted to investigate the main and interaction effects of two independent variables: Cognitive styles (field independence/dependence) of the learners and methods of teaching (Deductive and Inductive) on the learners' posttest scores. However, the regression analysis for WITHIN+RESIDUAL error term indicated that the learners' pre-test scores function as a covariate to their posttest scores (dependent variable). Thus, Analysis of Covariance was conducted before putting the covariate effect in the 2x2 factorial model.

## CHAPTER 4

### FINDINGS/RESULTS

Hypotheses One and Two predicted that a significant relationship exists between learners' cognitive styles of field-independence/dependence and teaching methodology (Deductive/Inductive) and learners' achievement. Hypothesis One predicted that field-independent learners will obtain higher post-test scores than field-dependent learners after having been taught in the deductive methodology. Hypothesis Two predicted that field-dependent learners will obtain higher post-test scores than field-independent learners after having been taught in the inductive methodology. Both hypotheses were supported. The regression analysis for WITHIN+RESIDUAL error term indicated that there is a significant relationship between the dependent variable (posttest score) and the covariate (pre-test score) ( $t_{(1, 76)} = 2.832$ ,  $p < .05$ ).

Thus, a covariate was put into a model of the 2x2 Factorial Analysis of Variance. The results indicated no significant main effect of either teaching methodology or cognitive style of field-independence/dependence on learners' scores ( $F_{(1, 76)} = .99$ ,  $p > .05$ ) vs.  $F_{(1, 76)} = 1.64$ ,  $p > .05$ ).



However, the analysis revealed a significant interaction effect of both independent variables (teaching methodology and field-independence/dependence on learners' scores) ( $F_{(1, 76)} = 10.66$ ,  $p > .01$ )

**Table 1**

\*\*\*\*\* Analysis of Variance -- design 1 \*\*\*\*\*

Test of Significance for Post using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN + RESIDUAL	357.24	72	4.96		
REGRESSION	39.45	1	39.45	7.95	.006
FIELD	4.12	1	4.12	.83	.365
TM	2.92	1	2.92	.59	.446
FIELD BY TM	52.88	1	52.88	10.66	.002
(Model)	104.58	4	26.14	5.27	.001
(Total)	461.82	76	6.08		
R-Squared =	.226				
Adjusted R-Squared =	.183				

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Effect Size Measures and Observed Power at the .0500 Level

Source of Variation	Partial ETA Sqd	Noncen- Trality	Power
Regression	.099	7.951	.792
FIELD	.011	.830	.169
TM	.008	.588	.151
FIELD BY TM	.129	10.658	.895

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Regression analysis for WITHIN+RESIDUAL error term

--- Individual Univariate .9500 confidence intervals

--- two-tailed observed power taken at .0500 level

Dependent variable .. Post

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t
PRE	.24409	.32022	.087	2.820	.006
COVARIATE	Low -95%	CL- Upper	ETA Sp.	Noncent.	Power
PRE	.072	.417	.099	7.951	.792

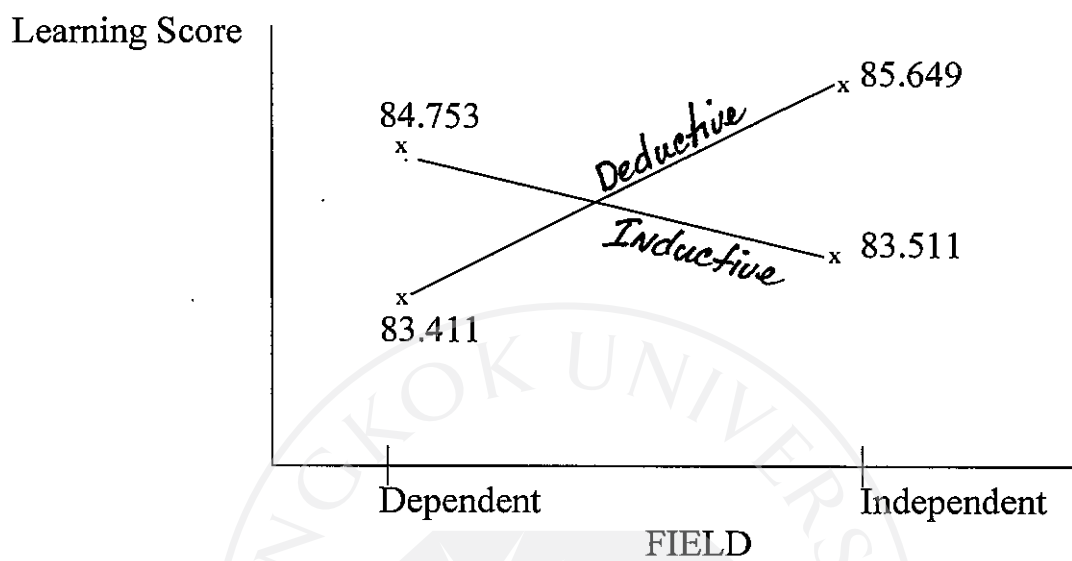
**Table 2** Adjusted Cell Means of Post-Test Scores Categorized By Cognitive Style and Teaching Methodology

FIELD	TM	POST	
		MEAN	N
field dependent	Deductive	83.411	17
	Inductive	84.753	16
	Total	84.082	33
Field independent	Deductive	85.649	22
	Inductive	83.511	22
	Total	84.580	44
Total	deductive	84.530	39
	inductive	84.132	38
	Total	84.331	77

The means in Table 2 indicated no significant differences between deductive and inductive teaching methodology nor between field-independence and field-dependence on learners' scores.

The insignificant main effect of each independent variable indicates that different types of teaching methodology, by itself, will produce no significant difference in students' learning score ( $\bar{x}_{\text{deductive}} = 84.530$  vs.  $\bar{x}_{\text{inductive}} = 84.132$ ) and neither does the students' cognitive style (field-independence/dependence) ( $\bar{x}_{\text{field-dependent}} = 84.082$  vs.  $\bar{x}_{\text{field-independent}} = 84.580$ ).

The line graph in Figure 1, nevertheless, indicated an interaction effect between the teaching methods and learners' cognitive style on their learning scores. That is, deductive teaching method will yield a higher learning score when the students are field-independent ( $\bar{x}_{\text{field-independent}} = 85.649$  vs.  $\bar{x}_{\text{field-dependent}} = 83.411$ ). Likewise, inductive teaching method will yield a higher learning score when the students are field-dependent ( $\bar{x}_{\text{field-dependent}} = 84.753$  vs.  $\bar{x}_{\text{field-independent}} = 83.511$ ).

Figure 1

Interaction Effects Between Teaching Method And Students' Cognitive Style On Their Learning Scores

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

This study provides continuing evidence for the positive relationship between cognitive style of field-independence/dependence and learning of English as a second language. The finding that field-independent subjects performed better with the deductive lesson and field-dependent subjects with the inductive lesson is consistent with earlier studies of this cognitive style.

In this study, it was viable to categorize second language learners according to their cognitive styles of field-independence/dependence using the Group Embedded Figures Test. This has served as a way of predicting their aptitude for second language learning. Having been categorized as either field-independent or field-dependent, the second language learners were given the treatments or teaching methodology assumed to correspond to their cognitive styles or aptitude. The field-independent learners were found to have achieved higher gains or scores with the deductive methodology and the field-dependent learners were found to have achieved higher gains or scores with the inductive methodology of teaching. As such, this study has provided additional substance to the line of research

pertaining to the Aptitude Treatment Interaction (ATI) Theory. According to the ATI paradigm specific learner characteristics can be matched with specific treatments to facilitate learning. Any treatment or teaching method interacts differently with different individuals. Since learners differ, the search for generally superior methods should be supplemented by a search for ways to fit the teaching or treatment to each kind of learner as this study has shown. In Thailand, this kind of matching of learner's cognitive style with specific teaching methodology as was done in this study should be considered a breakthrough in the second language learning and teaching field.

In addition to defining good language learners in terms of cognitive characteristics particularly field-independent/dependent, it is necessary to describe the learning strategies that facilitate their success in learning. Empirical research is needed that will provide evidence for the assumption that, for example, the learner with a great deal of field-independence does indeed make logical inferences concerning language cues and that those inferences facilitate his success in particular second language tasks. When some of the strategies of good language learners have been identified the

subsequent question can be faced: Can good language learner strategies be taught to less successful learners? An affirmative answer to this question has been assumed by some, but more research is needed to provide evidence for this line of thought.

Regardless of whether good language strategies can be taught, there remains a question of how learners with particular cognitive characteristics should be taught. Because second language acquisition is a multi-faceted task and learners with varying degrees of field-independence/dependence may prefer and excel in different situations, it may be appropriate to match teaching approaches to students as this research has proved. This matching has been tried in both second language teaching and instruction in other subject areas with some success. Research needs to proceed in this direction by placing students in instructional environments based on their cognitive styles by further investigating approaches that can be taken in individualized forms of instruction. In short, it is not appropriate to assume that all learners will benefit from the same kind of teaching methodology. It is one of the tasks of researchers to determine how teaching ought to vary from one learner to another.

Because this research is unique in its use of Thai students in a second language environment, replication of the findings in this study is recommended. In particular, it is necessary to do research using a) larger samples of students from different language groups with varying ages and language proficiency levels b) different measures of field-independence/dependence c) different constructs of cognitive styles d) different second language tasks. More research on the interaction between cognitive styles and second language learning from the perspectives of communicative and sociolinguistic competence is further recommended.

Finally since this study on the ATI Theory is the first of its kind in Thailand, it is recommended that more in-depth research in this area be conducted using larger samples in various age groups and which involve the learning of different second language skills.



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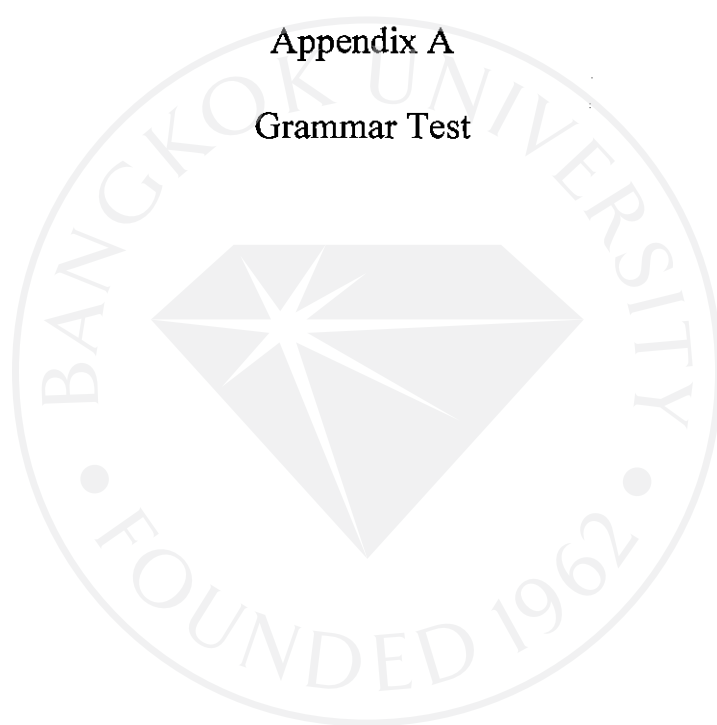
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**Appendix A**  
**Grammar Test**





6. Who earns ...; a doctor or a teacher?

- A. most                      C. much                      E. many more  
B. many                      D. more

7. There is ... water in the river during the dry season.

- A. more little              C. lesser                      E. not more  
B. less                      D. fewer

8. The headmaster says that ... in this class need to work harder.

- A. all pupil                      C. one boy                      E. everybody  
B. everyone                      D. some pupils

9. There are ... tickets left.

- A. very few of              C. few only                      E. few only of  
B. very a few                      D. very few

10. ... of the boys were late to school this morning.

- A. Somebody                      C. Not one                      E. Not much  
B. A few                      D. Only one

11. ... likes being kept waiting.

- A. Few person                      C. Nobody                      E. A few  
B. Few                      D. Not many people

12. 'Have you had enough to eat?' 'No, I can eat ....'
- A. no more                      C. enough                      E. any more  
B. some more                      D. many more
13. You have done ... work for today, and you need to rest.
- A. Lot                      C. plenty                      E. most  
B. many                      D. enough
14. The building ... we are now standing is a famous old fort.
- A. in front                      C. in front of which                      E. from which front  
B. in front of what                      D. of whose front
15. That is the house ... I was born.
- A. which                      C. what                      E. in what  
B. in who                      D. in which
16. ... are you waiting here?
- A. For whom                      C. Whom                      E. At whom  
B. To whom                      D. The who
17. You are not well. Why ... see a doctor?
- A. not you                      C. you no                      E. not go  
B. don't you                      D. you not



18. I wonder ... is calling me.

- A. whom                      C. who's                      E. the who  
B. who                      D. whose

19. We write letters to ... friends once a month.

- A. we                      C. us                      E. me  
B. our                      D. mine

20. Cars travel ... bicycles.

- A. fast as                      C. faster than                      E. fast than  
B. more faster than                      D. as fast than

21. This land belongs to us; it has always been ....

- A. for us                      C. to us                      E. our's  
B. our                      D. ours

22. Please give back to Mary ... book.

- A. its                      C. hers                      E. it's  
B. her                      D. she

23. Please tell me ... of these is your watch.

- A. who                      C. which                      E. whose  
B. what                      D. where

24. The girls agreed ... a present for the teacher.

- A. to buy                      C. buying                      E. buys  
B. to buying                      D. to buys

25. ... bicycle are you going to borrow tomorrow?

- A. Whose                      C. Where                      E. whom  
B. Who                      D. When

26. Where do ... come from?

- A. this apple                      C. this apples                      E. those apple  
B. these apples                      D. these apple

27. When he ... up, he saw it was raining.

- A. awoke                      C. awake                      E. wake  
B. woke                      D. waked

28. Is it all right ... some water to the curry now?

- A. to adds                      C. if added                      E. for add  
B. to add                      D. to adding

29. 'Please ... me away from here,' the child begged his mother.

- A. taking                      C. take                      E. to take  
B. taken                      D. takes

30. At what time ... the train arrive at the station?

- A. does                      C. is                      E. can  
B. do                      D. be

31. 'Please ... yourselves to the food,' the lady told us at the party.

- A. helps                      C. helping                      E. was helping  
B. help                      D. helped

32. Please show me how ... a birthday cake.

- A. make                      C. can make                      E. to making  
B. may make                      D. to make

33. Pranee has gone to get her pencil ....

- A. sharpened                      C. sharped                      E. sharp  
B. sharp                      D. sharpening

34. I ... wear the shoes because they were the wrong size.

- A. shouldn't                      C. could                      E. don't  
B. couldn't                      D. not

35. If ... going into town now I'd like to come with you.

- A. you're                      C. be                      E. is  
B. will                      D. have

36. The Rotary Club ... every Tuesday at the Oriental Hotel.

- A. meeting                      C. meet                      E. have meeting  
B. meets                      D. metted

37. Suddenly we ... a cry of pain and we felt scared.

- A. heard                      C. had hearing                      E. has hearing  
B. have hearing                      D. has heard

38. Please tell me how ....

- A. help I can                      C. will I helps you                      E. I can help you  
B. I can helps you                      D. helping I will be

39. 'Did your mother make this cake? 'No, I ....'

- A. made it ownself                      C. making by myself                      E. made it myself  
B. make it myself                      D. made it mine self

40. A new school ... on the hill.

- A. is to built                      C. will be built                      E. will be build  
B. is to build                      D. will build

41. I ... when the telephone rang.

- A. was sleeping                      C. am sleeping                      E. sleeps  
B. was slept                      D. slept

42. I ... to Samet Island although I live so close to it.

- A. have ever            C. have been never    E. have never been  
B. never been            D. been never

43. We ... you a telegram as soon as we ... in Bangkok.

- A. will send, will arrive    C. sent, arriving        E. send, arrived  
B. sending, are arriving    D. will send, arrive

44. Mr. And Mrs. Tan ... in their new house by the end of the year.

- A. will lived            C. will be living        E. had been living  
B. will be lived        D. will living

45. Mr. Lee ... through Thailand at this time tomorrow.

- A. travels                C. travelling            E. is travel  
B. will be travelling    D. have been travelling

46. Who do you think ... the best results in our class?

- A. will obtain            C. must obtained        E. shall obtains  
B. to obtain              D. will obtained

47. The watchman was not there. He ... gone home.

- A. will                    C. must had              E. was go  
B. must have            D. were gone

48. You ... the hall for badminton practice if you wish.

- A. should use                      C. had to use                      E. must have used  
B. must use                          D. may use

49. Do you know how much the gardener ... paid last month ?

- A. is                                      C. were                                  E. have been  
B. was                                    D. be

50. When we were at the cinema, some friends... home looking for us.

- A. has came                              C. have came                              E. come  
B. had come                              D. have come

51. While Tom was writing I ... television.

- A. watch                                  C. watched                                  E. had watch  
B. watches                                  D. watching

52. We were still eating our dinner when the visitors ....

- A. arrived                                  C. arriving                                  E. have arrived  
B. were arrived                              D. had arrive

53. 'Did you remember Noi's birthday?' 'Yes, I ....'

- A. her sent a gift                      C. to her sent a gift                      E. did sent a gift to her  
B. sent her a gift                      D. a gift to her sent



60. 'Where did you ... the magazine.' 'I ... it on your table.'

- A. leaves, left                      C. leaving, leaved                      E. leave, leaving  
B. left, left                              D. leave, left

61. My neighbour loves ... butterflies.

- A. collecting                              C. collect                                      E. for collecting  
B. collects                                      D. collected

62. While I ... the shops, I ... a beautiful dress in the shop window.

- A. was pass, see    C. was passing, was seeing    E. was passing, saw  
B. passing, saw    D. passed, seed

63. I am not sure if she ... able to carry such a heavy load.

- A. be    C. will be                                      E. were  
B. shall    D. could be

64. Unless you are willing to ... me, I shall not ... you.

- A. help, help                                      C. helped, helping                                      E. help, helped  
B. helping, helps                                      D. helps, help

65. I cannot understand what ....

- A. you saying                                      C. you are say                                      E. you are saying  
B. your saying                                      D. you been saying



66. Special train services ... for the Songkran holidays.

- A. provided                      C. will provide                      E. are been provided  
B. to be provided              D. are being provided

67. It is very easy ... in the Thai jungle.

- A. get loss                      C. to get lost                      E. got lost  
B. to got lost                      D. get lost

68. Excuse me, sir. You ... on the telephone.

- A. are wanted                      C. is wanted                      E. are want  
B. are wanting                      D. is wanting

69. We began ... hungry early in the afternoon.

- A. to get                      C. to getting                      E. get  
B. to got                      D. got

70. I may not be here when you ... from your holiday.

- A. returning                      C. returns                      E. return  
B. returned                      D. have return

71. By the time Seri and I came to the cinema the show ....

- A. had already start              C. has started already              E. started already  
B. have already started              D. had already started

72. Our headmaster and his wife ... England next month.

- A. are to visit                      C. will be visit                      E. will visited  
B. are visit                              D. will visiting

73. When it stopped raining, more children ... out to play.

- A. comes                                  C. coming                                  E. come  
B. came                                      D. are come

74. Before going to bed I always ... the door.

- A. locks                                      C. has locked                              E. lock  
B. locking                                      D. am locked

75. I watched television after ... the newspaper.

- A. read    C. I was read                                  E. I reading  
B. reading    D. I had reading

76. ... the policeman the thief ran away.

- A. Seeing                                      C. After see                                      E. When seen  
B. When he seeing                              D. After saw

77. One night my friend ... he saw a ghost.

- A. thinking                                      C. thinked                                      E. was think  
B. thought    D. got think

78. All the seats ... before we arrived at the cinema.

- A. have been occupied    C. has been occupy    E. has been occupied  
B. have occupied        D. had been occupied

79. Names of students who pass the examination ... in the newspapers.

- A. will be published        C. will published        E. are to publish  
B. will being published    D. are being publish

80. Yesterday Mother asked me ....

- A. were you tired        C. if I was tired        E. if I was tiring  
B. that I was tired        D. was I tired

81. Ali told Dang ....

- A. not to ride his bicycle        D. not ride the bicycle  
B. to not ride his bicycle        E. he is cannot ride his bicycle  
C. not ride his bicycle

82. The lazy students ... passed the examination ... they had tried harder.

- A. shan't have, though        D. did not, so  
B. could not have, even if    E. would not have, even  
C. must not, but

83. The farmer ... obtained a better crop if he had used good fertilizers.

- A. didn't                      C. might                      E. could  
B. will                      D. would have

84. If we had obtained four more points our team ... the champions in the athletic competition.

- A. would has been              C. might been              E. could been  
B. would have be              D. would have been

85. The boy might have been killed if the bus driver ... applied the brakes quickly.

- A. did not                      C. hadn't                      E. will not have  
B. may not have              D. do not

86. The film show hasn't started yet. We ... hurried.

- A. need not have              C. need not to              E. not need to  
B. need not has              D. no need to

87. After I have ... my food I shall go for a walk.

- A. eating                      C. ate                      E. eats  
B. eat                      D. eaten

88. Where is the fun fair ...?

- A. to held                      C. being held                      E. been held  
B. be held                      D. to be hold

89. You must ... the bottle before ... the medicine.

- A. shook, take                      C. shaking, take                      E. shake, took  
B. shakes, taking                      D. shake, taking

90. I ... him if he had told me the truth.

- A. will help                      C. would have helped                      E. had helped  
B. helped                      D. would help

91. ... that his father was ill, he ... home.

- A. Heard, return                      D. Hear, return  
B. Hearing, returned                      E. Had heard, had returned  
C. Heard, returned

92. ... very poor, they could not afford to ... a home.

- A. Be, buy                      C. Was, bought                      E. Had, buy  
B. As, buying                      D. Being, buy

93. They ... that Apantree was to ... the money.

- A. agree, keep      C. agreed, keep      E. had agreed, kept  
B. agreed, kept      D. agrees, keep

94. The Headmaster ... that the next day ... a holiday.

- A. announced, would be      C. announcing, being      E. announce, is  
B. announces, was      D. announced, is

95. My father ... takes a nap in the afternoon.

- A. alway      C. many time      E. on time  
B. always      D. many times

96. We should ... cycle in the middle of the road.

- A. ever      C. not to      E. neither  
B. never      D. seldom

97. The man hardly ... takes a drink during the day.

- A. never      C. cannot      E. mustn't  
B. not      D. ever

98. The guest has not arrived ....

- A. already      C. only      E. since  
B. just      D. yet

99. She ... goes to the cinema.

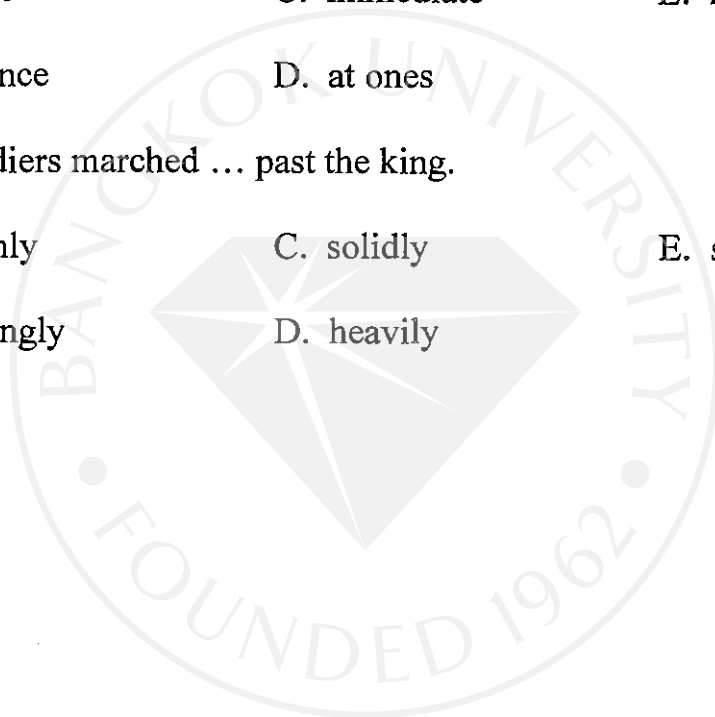
- A. already                      C. often                      E. many times  
B. ever                          D. since

100. My mother wanted me to finish my homework ....

- A. once                          C. immediate                      E. hurry  
B. at once                      D. at ones

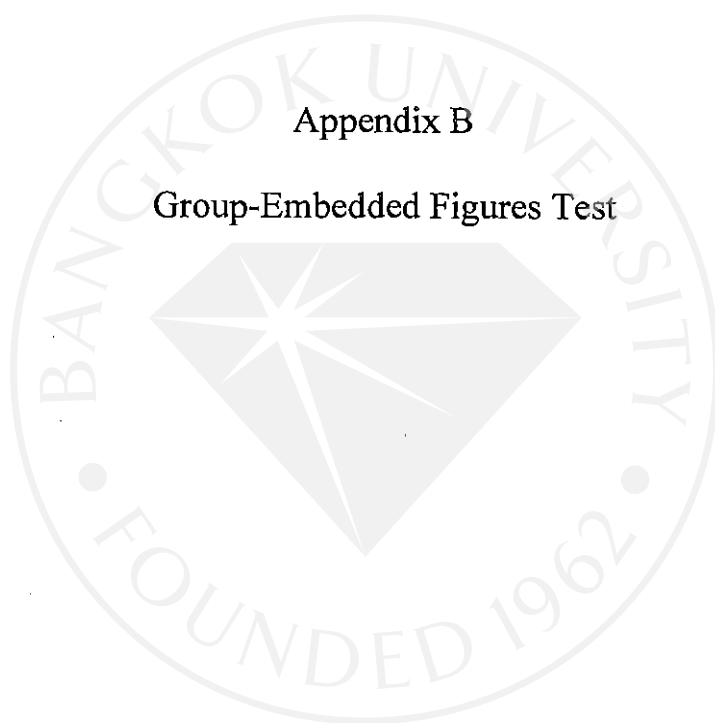
101. The soldiers marched ... past the king.

- A. firmly                          C. solidly                      E. smartly  
B. strongly                      D. heavily

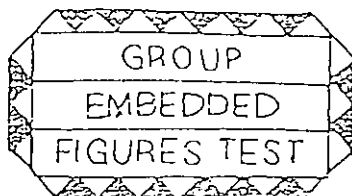


Appendix B

Group-Embedded Figures Test







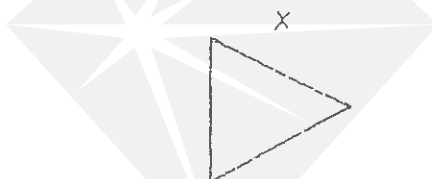
By Philip K. Oltman, Evelyn Rækin, & Herman A. Witkin

Name \_\_\_\_\_ Sex \_\_\_\_\_

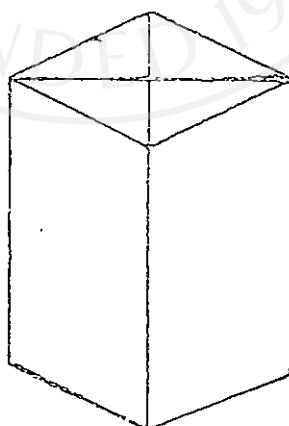
Today's date \_\_\_\_\_ Birth date \_\_\_\_\_

INSTRUCTIONS: This is a test of your ability to find a simple form when it is hidden within a complex pattern.

Here is a simple form which we have labeled "X":



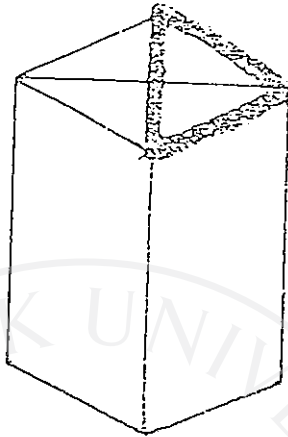
This simple form named "X", is hidden within the more complex figure below:



Try to find the simple form in the complex figure and trace it in pencil directly over the lines of the complex figure. It is the SAME SIZE, in the SAME PROPORTIONS, and FACES IN THE SAME DIRECTION within the complex figure as when it appeared alone.

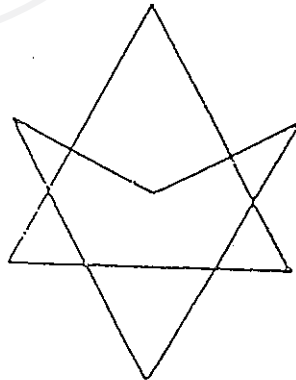
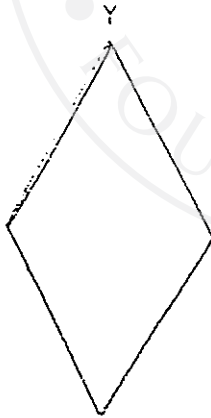
When you finish, turn the page to check your solution.

This is the correct solution, with the simple form traced over the lines of the complex figure:



Note that the top right-hand triangle is the correct one: the top left-hand triangle is similar, but faces in the opposite direction and is therefore not correct.

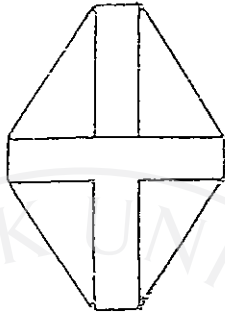
Now try another practice problem. Find and trace the simple form named "Y" in the complex figure below it.



Look at the next page to check your solution.

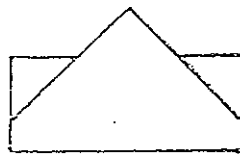
FIRST SECTION

1



Find Simple Form "B"

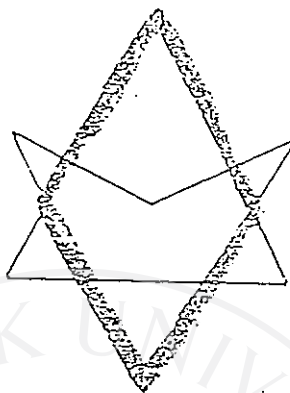
2



Find Simple Form "G"

Go on to the next page

Solution

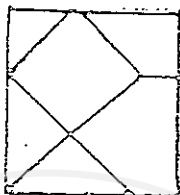


In the following pages, problems like the ones above will appear. On each page you will see a complex figure, and under it will be a letter corresponding to the simple form which is hidden in it. For each problem, look at the BACK COVER of this booklet to see which simple form to find. Then try to trace it in pencil over the lines of the complex figure. Note these points:

1. Look back at the simple forms as often as necessary.
2. ERASE ALL MISTAKES.
3. Do the problems in order. Don't skip a problem unless you are absolutely "stuck" on it.
4. Trace ONLY ONE SIMPLE FORM IN EACH PROBLEM. You may see more than one, but just trace one of them.
5. The simple form is always present in the complex figure in the SAME SIZE, the SAME PROPORTIONS, and FACING IN THE SAME DIRECTION as it appears on the back cover of this booklet.

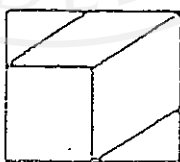
Do not turn the page until the signal is given.

3



Find Simple Form "D"

4



Find Simple Form "E"

Go on to the next page

5



Find Simple Form "C"

6

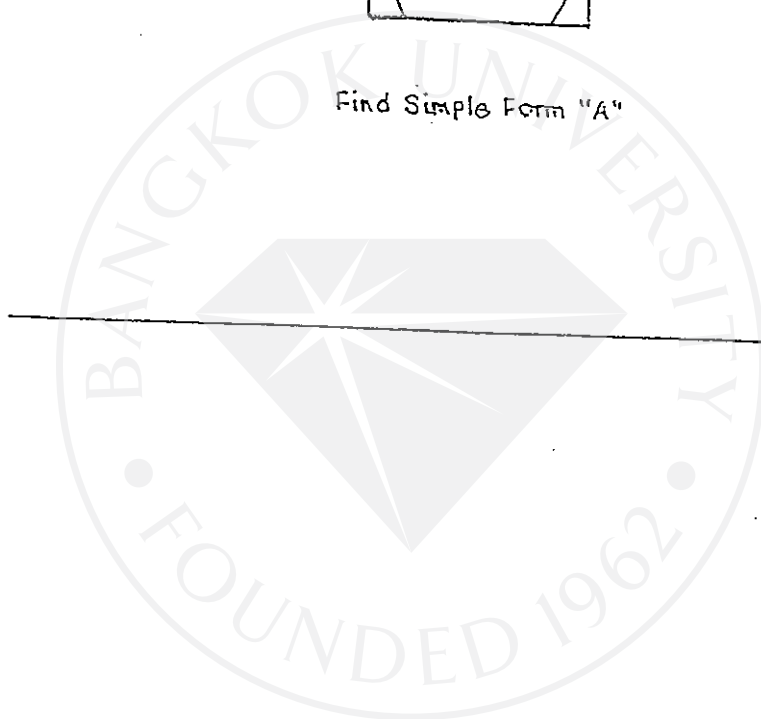


Find Simple Form "F"

Go on to the next page

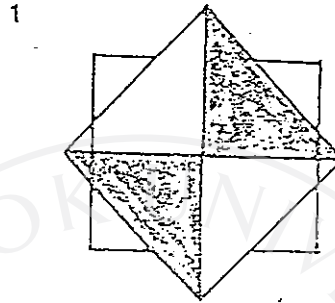


Find Simple Form "A"

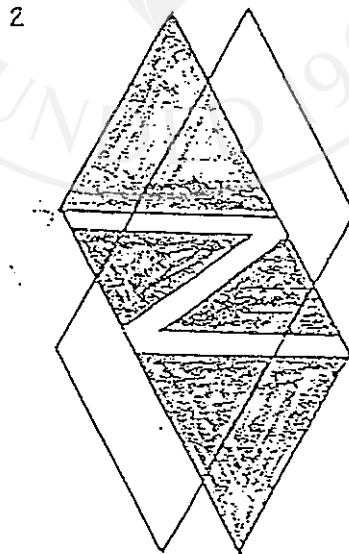


PLEASE STOP. Wait for  
further instructions.

SECOND SECTION



Find Simple Form "G"

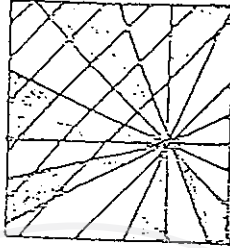


Find Simple Form "A"

Go on to the next page

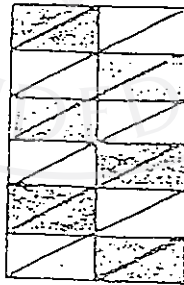


3



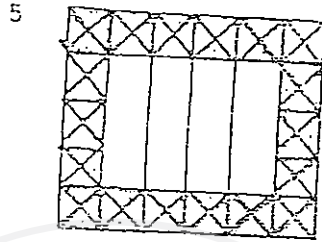
Find Simple Form "G"

4

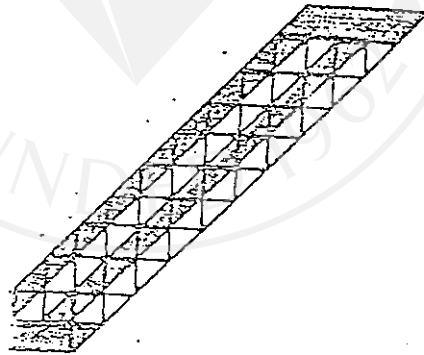


Find Simple Form "E"

Go on to the next page

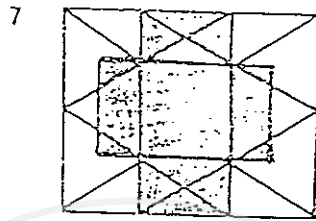


Find Simple Form "g"

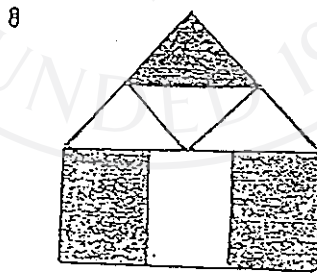


Find Simple Form "C"

Go on to the next page.



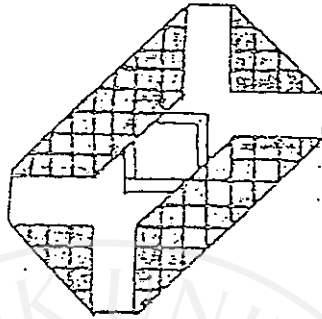
Find Simple Form "E"



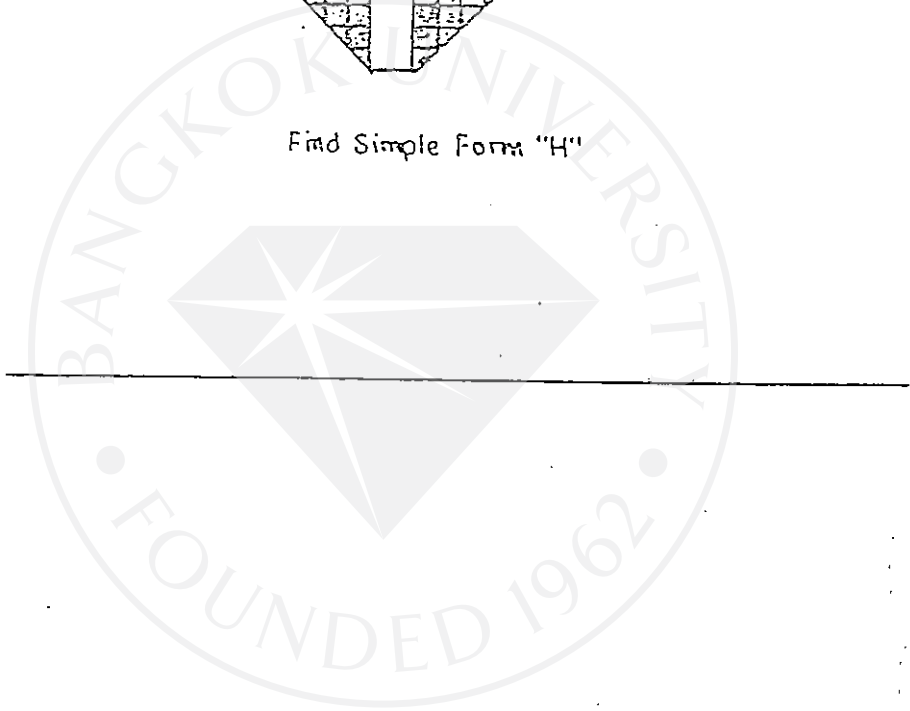
Find Simple Form "D"

Go on to the next page

9.



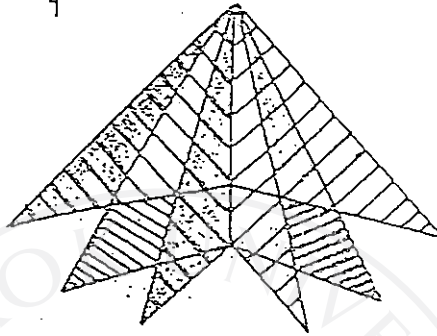
Find Simple Form "H"



PLEASE STOP. Wait for  
further instructions.

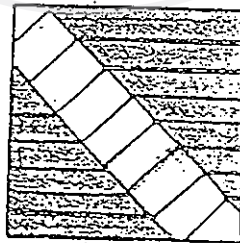
THIRD SECTION

1



Find Simple Form "F"

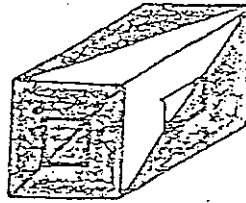
2



Find Simple Form "G"

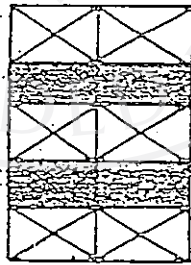
Go on to the next page!

3



Find Simple Form "C"

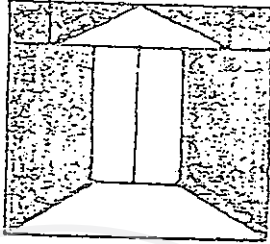
4



Find Simple Form "E"

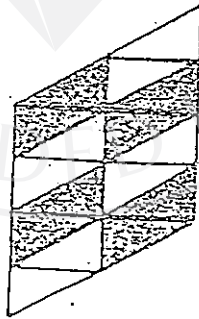
Go on to the next page

5



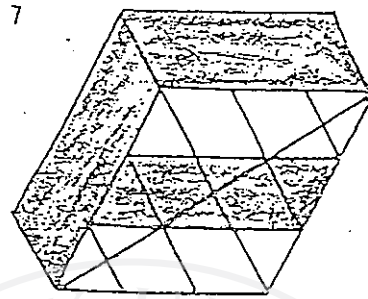
Find Simple Form "B"

6

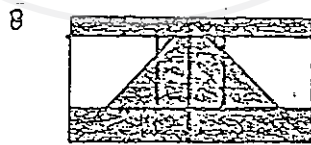
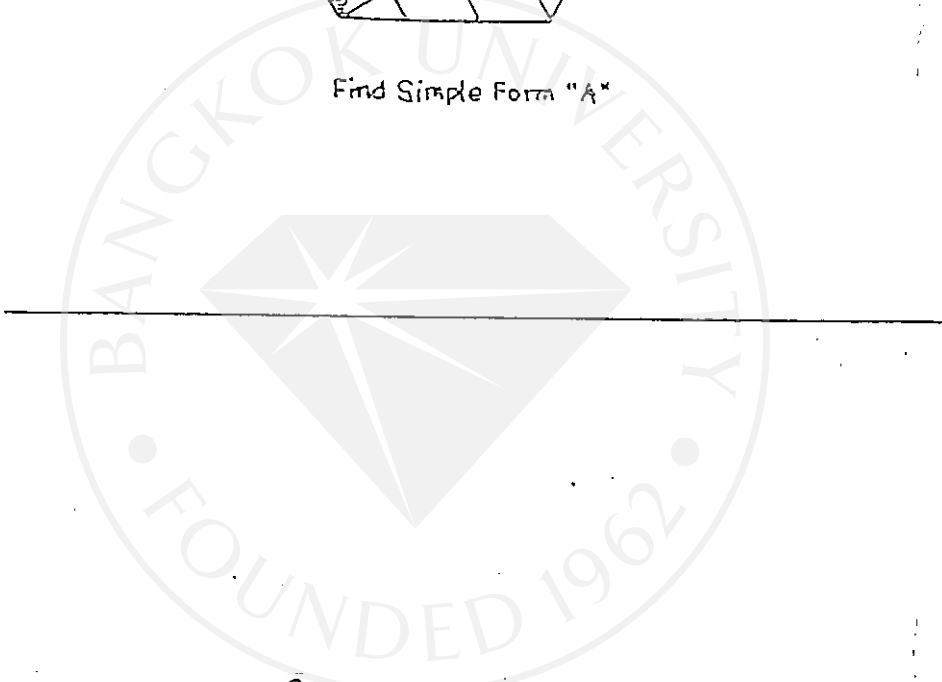


Find Simple Form "E"

Go on to the next page



Find Simple Form "A"

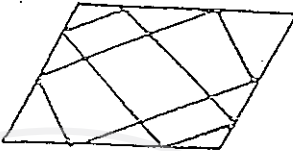


Find Simple Form "C"

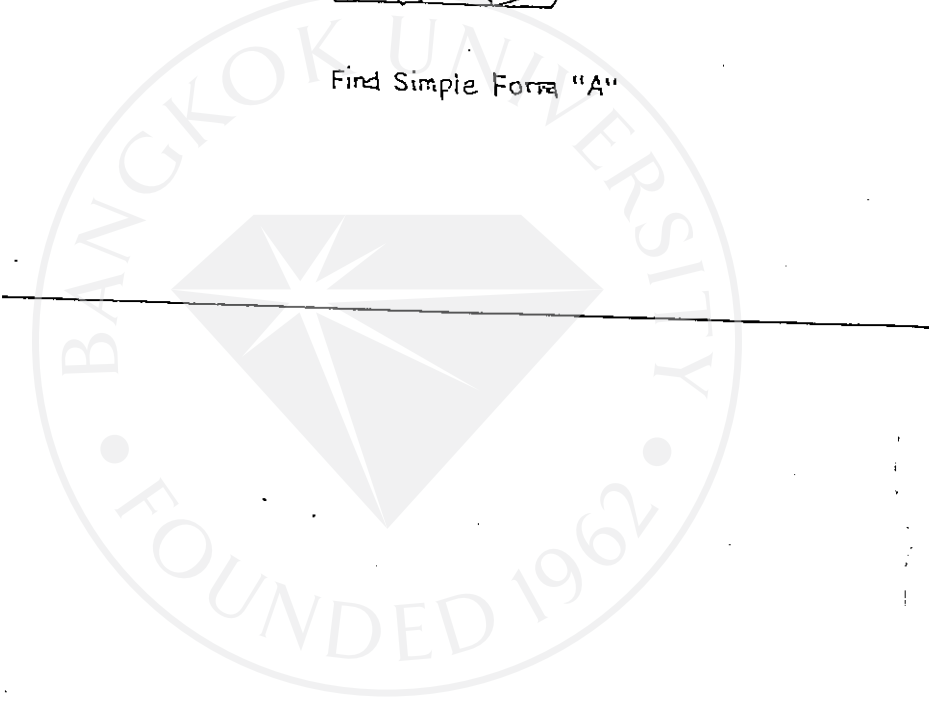
Go on to the next page



10



Find Simple Form "A"



PLEASE STOP. Wait for further instructions.

SIMPLE FORMS

