The Use of Feuerstein’s Instrumental Enrichment with Underprepared College Students: A Pilot Study

Michael Kieta

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THE USE OF FEIJERSTEIN'S
INSTRUMENTAL ENRICHMENT
WITH UNDERPREPARED COLLEGE STUDENTS:
A PILOT STUDY

A Thesis
Presented to
The Faculty of the Department of Psychology
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
of the Requirements for the Degree
Masters of Arts

by
Michael A. Kieta
July, 1983
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THE USE OF FEUERSTEIN'S INSTRUMENTAL ENRICHMENT WITH UNDERPREPARED COLLEGE STUDENTS:
A PILOT STUDY

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THE USE OF FEUERSTEIN'S
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WITH UNDERPREPARED COLLEGE STUDENTS:
A PILOT STUDY

Michael Anthony Kieta
July, 1983

Directed by: W. F. Pfohl, D. L. Redfield, and J. O' Connor

Department of Psychology
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This pilot study investigated the usage of Feuerstein's (1980)
Instrumental Enrichment with underprepared college students. Open
admissions policies in colleges and universities have resulted in the
enrollment of many students who are underprepared to meet the academic
task demands. Courses have been developed by the colleges and
universities to remediate the academic deficits of underprepared
students. Remedial courses using traditional educational methods have
been largely ineffective. Cognitive process instruction (CPI) is an
area of educational research that recently began to receive increased
attention in the field of remedial education. The goal of CPI has been
to develop the cognitive/thought processes of students. Feuerstein's
Instrumental Enrichment (IE) is a CPI program which had success in
remediating the thinking and learning deficits of adolescent students.
IE had not been used with a college population in the United States
prior to this study. The major question was whether the use of IE
would enhance the thinking and learning skills of underprepared college
students and, thus, increase their abilities to achieve satisfactorily
in college. The study included 65 college student subjects
administratively defined as underprepared (ACT composite score below
16). The subjects were enrolled in four sections of a "Success
Strategies course developed for underprepared students. The 29 experimental subjects received approximately 13 hours of IE instruction. The 36 control subjects received an equivalent amount of instruction in college "success strategies" such as goal setting, decision making, and study skills. The dependent variables were: (a) intelligence, as measured by the Nonverbal Battery of the Lorge-Thorndike Intelligence Test; (b) self concept, as measured by the Tennessee Self Concept Scale (TSCS); (c) grade point average (GPA); (d) attrition/withdrawal rate of students; (e) descriptive data obtained from experimenter-designed study habits questionnaires and course evaluations. An analysis of covariance was used to analyze the Lorge-Thorndike and TSCS pretest and posttest scores. An analysis of variance was used to analyze the GPA data; and the attrition data were submitted to a chi-square analysis. A variety of appropriate procedures (e.g., t-test, chi-square, analysis of variance) were used to analyze the descriptive data obtained from the study habits questionnaires and course evaluations. No significant differences between groups were found for the Lorge-Thorndike, TSCS, GPA, or attrition rate analyses. The GPA data analyses indicated that: (a) mean GPA declined significantly across both groups when remedial course grades were removed from overall GPA ($F = 55.15; df = 2, 88; p < .01$); and (b) overall mean GPA declined significantly across both groups from the Fall 1981 to Spring 1982 semesters ($F = 19.98; df = 1, 40; p < .01$). The only significant between group difference for the descriptive data analyses indicated that the experimental group anticipated and reported studying more hours per week than the control group ($F = 8.81; df = 1, 40; p < .01$). The GPA results were the reverse
of the hypothesized effect. The reasons for the differences in study hours were not clear. The hypothesis that IE would enhance the thinking and learning skills of underprepared college students was not supported. Three interpretations that together or separately may account for the lack of a treatment effect were: (a) IE, as it was applied in this study, was not a valid or appropriate CPI intervention with underprepared college students; (b) the duration of the IE treatment was insufficient to produce the hypothesized effects; and/or (c) the evaluation instruments were not sensitive to changes in the experimental group students, if in fact changes did occur. It was recommended that future research increase the duration of the IE treatment; apply or develop more sensitive evaluation instruments; and/or consider alternative programs.
Chapter I
Introduction

The educational philosophy that all high school graduates should have an opportunity to further their formal education has led to widespread liberal and open admissions standards among public institutions of higher learning. Once admitted to a college or university, many students find themselves underprepared for meeting the academic task demands. In turn, many colleges and universities find themselves underprepared for meeting the remedial needs of students lacking in study skills and knowledge of content (Cross, 1976; Roueche & Snow, 1977). These "underprepared students" have been labeled as "New Students," "disadvantaged," "socioeconomically deprived," "socially and culturally disadvantaged," "culturally poor," "poverty stricken," "culturally alienated," "high-risk," and "culturally deprived" (Cross, 1976; Roueche & Wheeler, 1973; Maxwell, 1979). In this thesis these students will be referred to as "underprepared students" for descriptive, rather than diagnostic or classification purposes.

Open admissions means equal access for all to higher education (Decker, Jody, Brings, 1976). During the 1950s and 1960s colleges and universities had moved away from previous nonselective admissions policies due to a surplus of applicants for higher education (Cross, 1976; Roueche & Snow, 1977). Cross (1976) referred to the 50's and 60's era of selective admissions as, "the heyday of educational
meritocracy" (p. 26). Despite the selective recruitment of students, no more than half of those freshmen admitted graduated from the selective institutions (Roueche & Snow, 1977).

Somewhat adversely, the late 1960s also marked a movement toward equal educational opportunity (Cross, 1976). Increased financial aid, the growth of community colleges, and a return to open admissions policies virtually eliminated poverty and poor educational preparation as a barrier to college access by the mid 1970s (Cross, 1976). Maxwell (1979) suggested that declining enrollments during the 1970's and the threat of financial failure also influenced colleges to admit and attempt to retain underprepared students. In a survey of 139 community colleges and 134 senior colleges across the nation, Roueche and Snow (1977) found that 40 percent of public senior colleges and 38.6 percent of community colleges reported having an open admissions policy.

An area of research related to open admissions has involved the prediction of college success. Most prediction research has focused on student attrition. Studies of attrition rates indicated that an average of 40 to 50 percent of entering freshmen did not graduate from college (Bean, 1980; Cope and Hannah, 1975; Summerskill, 1962). However, variability among attrition rates was wide, ranging from 12 to 82 percent in the 35 studies reviewed by Summerskill (1962).

Prediction research has investigated those variables believed to influence college completion. The variables have included the academic ability, personality, motivation, goal commitment, and background characteristics of persisting versus non-persisting college students. The results of the many studies using non-intellective predictors, such
as personality and background characteristics, have been inconclusive (Fishman, 1962; Margrain, 1978). Twenty-one years ago, Fishman (1962) found that the most common predictors of college success were high school grades and scores on standardized aptitude tests. Although screening applicants for admission is no longer the purpose of testing in the open admissions college, test scores are still commonly used for placing students, especially in the relatively large colleges (Roueche & Snow, 1977).

Many colleges have created special developmental or remedial courses as the primary instructional response to the influx of underprepared students resulting from open admissions. Roueche and Snow (1977) found that 93 percent of community colleges and 78 percent of the four-year colleges were providing remedial courses. They further stated that these figures indicated an increase in remedial courses of more than 35 percent over surveys conducted in 1973. Roueche and Snow’s opinion was that the existence of remedial courses did not necessarily result in an improved success rate for underprepared students.

Despite the influx of underprepared students and the increase in remedial courses designed for them, many critics maintained that college remedial courses were largely failures (Davis, Burkheimer, and Borders-Patterson, 1975; Maxwell, 1979; Roueche and Kirk, 1973; Roueche and Pitman, 1972). As a result of the past failures of college remedial courses, the attention of college educators turned to "non-traditional" educational approaches (e.g., mastery learning, programmed instruction, self-paced learning modules). A number of books have been written concerning the development of successful
remedial programs using non-traditional approaches (e.g. Cross, 1976; Gould & Cross, 1972; Maxwell, 1979; Roueche & Kirk, 1973; Roueche & Pitman, 1972; Roueche & Snow, 1977).

Educational researchers active in the field of college remediation, such as Cross (1976), and Maxwell (1979), have recognized the importance of considering cognitive factors when developing instructional programs for underprepared students. However, these remedial education researchers have often appeared to confuse cognitive "process" factors with academic or content factors. Researchers in cognitive psychology and cognitive education have emphasized the "process" component of learning and thinking. This "process" component has not been explored sufficiently in the field of college remediation. Additionally, researchers in Cognitive Process Instruction (CPI) have begun to investigate the possibility of "teaching" cognitive process.

CPI is an educational approach designed to help students develop their abilities to think and learn. The emphasis of CPI has been on teaching students how to think and learn, not what to think and learn (Lochhead & Clements, 1979). Various approaches to CPI have been instituted in colleges across the United States to help a variety of college students (e.g. Fuller, 1981; Lochhead & Clements, 1979; Whimbey & Lochhead, 1980).

Feuerstein's Instrumental Enrichment (IE) was a CPI approach which has not been applied to a college population in the United States. IE was a comprehensive educational program which was originally designed for use with adolescents having deficits in thinking skills necessary for academic and social success (Feuerstein, 1980). The aim of this study was to apply IE to a population of
underprepared college students.

The rationale for the use of IE with underprepared college students was threefold. First, the characteristics of underprepared college students were similar to those of the original IE target population (e.g., deficient academic skills, dependent rather than active learning, difficulty in working toward abstract goals, poor self image). Second, educational researchers active in the field of college remediation (e.g. Cross, 1976; Maxwell, 1979; Roueche and Snow, 1977) stressed the importance of motivational factors in college remedial programs. Feuerstein (1980) also placed a strong emphasis on motivational development. Finally, the IE program had, theoretically, the potential for improving the thinking and learning skills of those college students who needed such improvement most, the underprepared students.

Statement of Problem

The philosophy of equal educational opportunity for all has been the basis for open admissions standards in many colleges and universities. Open admissions have been perpetuated, in part, by declining enrollments and the threat of financial failure to the colleges and universities. Many students admitted by open admissions found themselves underprepared for meeting the academic task demands of higher education. In turn, many universities have not met the needs of underprepared students. Remedial education in college has been generally unsuccessful, especially during the 1960s (Davis et al., 1975). However, there have been indications that underprepared students could succeed if provided with appropriate programs (Cross, 1976; Maxwell, 1979; Roueche & Snow, 1977). An area of education
relatively unexplored by college remedial educators has been CPI, which proposes to improve students' abilities to think and learn. Feuerstein's IE was a CPI program which has not been applied to a college population in the United States, but has been used with adolescents to remediate cognitive processes.

It was the primary hypothesis of this thesis that IE could enhance the thinking and learning skills of underprepared college students, thereby increasing their abilities to achieve satisfactorily in college. The specific secondary hypotheses were as follows:

1. Compared to the control group, the IE experimental group would demonstrate significantly greater abilities to think and reason as measured by the Nonverbal Battery of the Lorge-Thorndike Intelligence Test.

2. Compared to the control group, the IE experimental group would demonstrate a significantly improved self concept as measured by the Tennessee Self Concept Scale.

3. Compared to the control group, the IE experimental group's improved thinking skills would be reflected in a significantly higher grade point average in the Fall 1981 semester, and the Spring 1982 semester.

4. Compared to the control group, the IE experimental group's improved thinking skills and higher grade point average would result in a significantly lower attrition rate in the Spring and Fall 1982 semesters.
Chapter II

Review of the Literature

This review of the literature surveyed research in prediction of college success, remedial college education, and cognitive process instruction as it related to underprepared college students. Researchers involved with prediction of college success have attempted to develop a means of predicting whether incoming college freshmen will complete college. College educators in the field of remediation have been concerned with providing the help that underprepared students needed to adjust to college and successfully complete college level courses. Researchers in cognitive process instruction have studied the thinking and learning processes contributing to academic success. The research on cognitive processes has been applied through attempts to teach students how to think and learn more effectively.

Prediction of College Success

Due to the considerable cost involved in student recruitment and education, the prediction of student success has been of special interest in higher education. Research on prediction of college success has focused on student attrition and factors influencing it.

Student Attrition Rates

Summerskill (1962), in a review of 35 studies of college student attrition between 1913 and 1962, found the median loss of students in four years to be about 50 percent. He concluded that attrition rates
had not greatly varied between 1920 and 1962. Cope and Hannah (1975) reported that more than ten million freshmen met the entrance requirements of over 2500 two-year and four-year colleges during the 1960s, an era of selective admissions. Fewer than half of those students graduated on schedule, and 30 to 40 percent apparently never earned degrees. According to Bean (1980), student attrition has not changed appreciably in 50 to 60 years.

However, considerable variability existed within the rates of student withdrawal, depending on the institution and students studied (Cope and Hannah, 1975). For example, Summerskill (1962) found attrition rates varied from 12 percent to 82 percent in the 35 studies he reviewed. The great variation in attrition rates among institutions suggests that it may be possible to improve the rate of retention in institutions exceeding the 40 to 50 percent level of attrition.

While the median attrition rate of 50 percent for all students may seem high, the percentage of underprepared student dropouts has been considerably higher. In 1962, Summerskill reported attrition rates for poor students ranged from 78 to 91 percent. Fifteen years later, Roueche and Snow (1977) found similar results, with 75 to 90 percent of underprepared students failing to complete college. It can be seen that increased retention of underprepared students provides enormous potential for reduced college attrition rates, at least in terms of gross percentages.

Predictors of Student Attrition

Prediction research has sought to explore and explain the variables involved in college student attrition (Bean, 1980). Fishman (1962) reported that there were 580 college guidance and selection
studies from 1948 to 1958. He wrote that, "this research area is undoubtedly among those most intensively investigated in the entire field of educational research" (Fishman, 1962, p. 668). Fishman categorized predictive studies according to their use of intellective predictors, non-intellective predictors, or a combination of both. He defined intellective predictors as aptitude and intelligence test scores, achievement test scores, high school rank or high school grade point average. Non-intellective predictors included scores on personality inventories, motivational tests, interest inventory information, interviews and personal ratings, biographical information, and study-habits inventory data.

Fishman (1962) found that the most widely used predictors were high school grades and scores on standardized aptitude tests. The usual criterion in the studies was first year college grade point average. Fishman (1962) stated that the average multiple correlation obtained when using high school GPA and standardized test scores to predict first year college GPA was approximately .55. The addition of a personality test to one or both of the usual predictors (high school GPA, standardized aptitude test score) usually produced a gain of less than .05 in the multiple correlation prediction equation (Fishman, 1962).

Since Fishman's survey, further research on non-intellective predictors has added little to prediction efficiency. Margrain (1978) reviewed the literature on student characteristics and their potential for predicting academic achievement. She stated that, "Results are not optimistic, often contradictory, and on the whole account for little variance beyond that accounted for by tests of intellectual ability"
Margrain, 1978, p. 111). Bianchi and Bean (1980) found SAT scores to be effective in discriminating between high and low achieving students and used the California Personality Inventory for a non-intellective predictor. They concluded that the California Personality Inventory and similar measures were of limited value in predicting college student attrition.

A complex utilization of non-intellective predictors was Bean's (1980) Causal Model of Student Attrition. Bean synthesized research findings on turnover in work organizations and student attrition in developing his model. He utilized path analysis and multiple regression analysis in analyzing 28 variables involved in student attrition (e.g. socioeconomic status, institutional quality, university GPA, goal commitment, major, institutional commitment). Despite the sophistication and complexity of Bean's model, he was able to account for only 21 percent of the variance in dropout for females and 12 percent for males.

There has also been little change since Fishman's (1962) survey in the predictive efficiency of intellective predictors. For example, the Technical Report for the ACT assessment program (1973) reported correlations of .465 to .523 in most studies between ACT scores and first year college grades, a correlation similar to Fishman's (1962) findings. It appears that standardized test scores have retained their predictive value for success in the first year of college.

Overall, recent prediction research results appear to differ little from those reported by Fishman in 1962, who concluded his chapter with a call for a "moratorium on prediction" (p. 688). He advocated an alternative (perhaps radical for the times) approach to
higher education which emphasized the development of students, rather than the selection of students.

Fishman's recommendation that students be developed, rather than selected, may have the potential to be realized in the open admissions college. In current open admission colleges, the purpose of screening applicants through testing is no longer selection, but placement. Roueche and Snow (1977) found that 86.6 percent of the four-year colleges they surveyed used the ACT or SAT for diagnostic/placement purposes. They also found that testing was the most commonly used placement method, especially in the relatively large colleges. In the open admissions college, prediction of success and selection of students is no longer sufficient. Educational intervention is also necessary.

Summary

The literature supported the use of standardized aptitude tests (e.g. ACT, SAT) in the prediction of college success. Standardized aptitude test scores and/or high school GPA have emerged as the best single predictors of first year college grades. Additionally, poor or failing grades at the beginning of a college career are highly predictive of withdrawal (Summerskill, 1962). Finally, the question of prediction is moot in the open admissions college, since the applicant will be admitted regardless of test score, high school GPA, personality, or background characteristics. The issue of how to best help the underprepared student admitted through open admissions remains, and will be addressed in the next section.
Remedial Education in College

Special developmental or remedial courses have been the primary response of higher education to the underprepared student (Roueche & Snow, 1977). In this section, the background and rationale for remedial education in college, the current status of remedial efforts, and the characteristics of underprepared college students will be reviewed.

Background and Rationale

In their survey of 273 community and senior colleges, Roueche and Snow (1977) found that 93 percent of community colleges and 78 percent of four-year colleges provided remedial courses. Roueche and Snow (1977) observed that these results indicated a 35 percent increase in remedial courses over the findings of similar surveys conducted four years previously. A variety of terms have been contrived to describe the special courses designed for underprepared students: remedial, developmental, directed, compensatory, guided, basic, and advancement studies (Roueche & Kirk, 1973). For purposes of this study the descriptor "remedial" will be used because it is the most commonly used term.

Courses for remediation of academic deficiencies are not new; the first course of this type was introduced at Wellesley College in 1894 (Cross, 1976). Early remedial efforts were relatively rare, and of low priority. Remediation in higher education became important with the advent of open admissions, as many students entered college without the academic skills needed to succeed at college level instruction (Cross, 1976; Roueche & Snow, 1977).
The term "potential learners" has been the key to the rationale behind remedial education. Roueche and Wheeler (1973) and Roueche and Pitman (1972) emphasized that the underprepared student can learn, and that this fact must be recognized in higher education. Bloom, Hastings, and Madaus (1971) have declared that 95 percent of students can achieve a grade of A in a subject, given sufficient time and appropriate types of help. According to Bloom (1976), Societies in the past have relied on prediction and selection of talent as the means for securing a small group of well-educated persons. . . Modern societies no longer can content themselves with the selection of talent; they must find the means for developing talent. (p. 17)

Maxwell (1979) stated that colleges must continue to offer remedial services because the average student's academic skills have declined, and there are too few of the best prepared students.

Current Status

Despite Bloom's (1976), Maxwell's (1979), and Roueche and Snow's (1977) arguments concerning the need for the remediation of academic skills within the college setting, critics have maintained that traditional college remedial courses have been failures (Davis et al., 1975; Roueche & Kirk, 1973; Roueche & Pitman, 1972). Traditional remedial courses covered "traditional" content (e.g. English, mathematics) using a "traditional" teaching method (e.g. lecture).

In 1968, Roueche found that as many as 75 percent of low achieving students withdrew from college in the first year. More recently, Roueche and Snow (1977) reported that as many as 90 percent of students enrolled in remedial programs during the 1960s never finished them.
Maxwell (1979) wrote, "It is generally conceded that remedial college courses do little to increase the retention of underprepared college students over what might be expected from their high school grades and their test scores" (p. 22). Roueche and Snow (1977), while discussing the failure of past remedial efforts, made the comment, "Little wonder that critics of community colleges soon referred to the open door admissions policy as a 'revolving door' policy—easy to enter and even easier to exit" (p. 8).

In response to the general failure of past remedial efforts, college remedial educators turned to "non-traditional" educational approaches (e.g. mastery learning, programmed instruction, self-paced learning modules). Gould and Cross (1972, p. 1) defined non-traditional study as, "a group of changing educational patterns caused by the changing needs and opportunities of society." A number of books have been written concerning the development of successful remedial programs using non-traditional approaches (e.g. Cross, 1976; Gould & Cross, 1972; Maxwell, 1979; Roueche & Kirk, 1973; Roueche & Pitman, 1972; Roueche & Snow, 1977). One factor that was consistent across authors was an emphasis on the need for remedial programs, rather than isolated courses. The authors also agreed that if remedial programs are to be successful they must attempt to deal with cognitive, emotional, and social factors involved in the adjustment to college, as well as appropriate academic content.

In summary, college remedial efforts have progressed from traditional approaches (e.g. content based lectures), to more non-traditional approaches (e.g. mastery learning, programmed instruction, self-paced learning modules), as well as emphasizing
integrated remedial programs that include cognitive, social, and emotional components. Concurrent with these developments, educational researchers in the remedial field (e.g. Cross, 1976; Maxwell, 1979; Roueche & Snow, 1977) have devoted considerable effort to studying the cognitive, emotional and social makeup of underprepared students. The importance of investigating the characteristics of underprepared students was justifiable, since the student's deficiencies must be identified before remediation is possible.

Characteristics of Underprepared Students

Cross (1976), in her review of underachieving students, described five perceived causes of low academic achievement: poor study habits, inadequate mastery of basic academic skills, low academic ability or low IQ. psychological-motivational blocks to learning, and sociocultural factors relating to deprived family and school backgrounds. Roueche and Snow (1977) provided a similar description.

Such students have discernible deficiencies in such skill areas as reading, writing, and arithmetic. They do not understand the mechanics of good study procedures. They have unimpressive standardized test scores. And their backgrounds of race, culture, and class place them at a disadvantage in contention with the large number of students applying for entry into college. (p.2-3)

Klingelhofer and Hollander (1973) found the following characteristics of the educationally disadvantaged: (a) lack of proficiency or practice in "thinking" approaches to problems; (b) strong leanings toward vocational or occupational outcomes;
(c) bewilderment and feelings of being out of place, particularly at the onset of the college experience; (d) difficulties in working toward abstract goals or for symbolic rewards; and (e) limitations on freedom of choice of institution or program.

Maxwell (1979) described underprepared students as having external loci of control. That is, they feel that they do not control their own lives, and feel unable to manage their environment and to obtain rewards by their own behavior. Maxwell further stated that many students (especially underprepared students) are externally motivated, i.e., they will perform a task because success will lead to an external reward, such as money, grades, increased social status, or praise. She believed that underprepared students usually do not derive satisfaction or pride in accomplishing difficult tasks and do not seem to be motivated toward competency or mastery of their environment. Maxwell pointed out that external motivation of students is inconsistent with the views of most college professors who generally assume students are intrinsically motivated.

Cross (1976) and Roueche and Snow (1977) described underprepared students as having poor self-images due to a "failure identity" developed in their past school experiences. They stressed that remedial programs should help students develop "success identities" and improve their self-images. Maxwell (1979) disputed this point arguing that the reverse is often true; that underprepared students often have high expectations for college although they will need intensive help if they are to achieve their goals. Maxwell admitted that the underprepared student's high expectations may reflect a sort of bravado or denial in their reaction to college.
Finally, Cross (1976) and Roueche and Snow (1977) emphasized that the majority of low-achieving students admitted through open admissions were not from ethnic minorities. Rather, underprepared students "come from all walks of life, all levels of socioeconomic background, all levels of ability" (Roueche and Snow, 1977, p. 31).

**Summary**

Traditional remedial education efforts at the college level, particularly those of the 1960s, have been largely ineffective. More recent efforts have applied non-traditional educational methods. Educational researchers such as Cross (1976), Maxwell (1979), and Roueche and Snow (1977) have provided descriptions of programs and procedures which they have found to be successful with underprepared students. Many of the cognitive, social, and emotional characteristics of underprepared students have been studied in order to better understand the nature of their problems in college. Furthermore, there appears to be a growing emphasis on integrated remedial programs designed to meet the cognitive, social, and emotional needs of underprepared students, although not all programs address all of these needs. Social and emotional factors will not be directly addressed in this study; rather, the emphasis will be on cognition and Feuerstein's Instrumental Enrichment (IE) as a form of cognitive process instruction (CPI).

**Cognitive Process Instruction**

Cognition may be defined as "the act or process of knowing" (Merriam-Webster Dictionary, 1974, p. 148). Basically, then, cognition and cognitive factors are related to the process of thought and the
process of learning. However, not all educators or researchers have agreed on the nature of cognition and cognitive factors.

When Cross (1976) and Maxwell (1979) referred to "cognitive" factors, it appeared they were describing academic or content factors. Although both authors discussed the "cognitive styles" of students, they did not sufficiently address the possibility of enhancing the cognitive/thought processes of underprepared students. It seems reasonable to speculate that many of the academic difficulties experienced by underprepared students are due to ineffectual thinking, reasoning, and learning. It also appears that the potential for changing ineffectual thinking and learning processes has been relatively unexplored by remedial college educators.

Researchers in CPI believe that students can be taught to think and learn more effectively (Lochhead & Clements, 1979). From the CPI perspective, college remedial efforts would not necessarily be criticized for what has been attempted in the past, but rather for what has not been attempted. Underprepared students need, and will continue to need, instruction in basic academic content. However, from the CPI perspective, underprepared students need instruction in the processes of thinking and learning. Thus, CPI would be used to enhance, but not replace, current traditional and non-traditional remedial efforts.

The fields of cognitive psychology and cognitive education are diverse and extensive. CPI is a generic title for a variety of educational approaches designed to help students develop their abilities to think and learn. This review will focus on research involving the use of CPI with college students. The theoretical
rationale for a cognitive perspective in higher education; current methods of CPI in higher education; and a summary and critique of current CPI methods in higher education with regard to underprepared students are discussed.

Theoretical Rationale for Cognitive Education

During the 1970s, interest in the mind and cognition was renewed (Harmon, 1979). Advocates of a cognitive educational perspective proposed that the behavioral stimulus-response learning paradigm emphasized in the 1950s and 1960s did not deal adequately with the varieties of learning occurring in classrooms, especially college classrooms (Leith, 1977; Harmon, 1979; Lochhead, 1979; Sprague, 1981).

While discussing the decline of the behavioral perspective, Sprague (1981, p. 25) stated, "Instructional developers, especially in higher education, must adapt their instructional models to the cognitive perspective, if they hope to have the opportunity to effectively improve instruction at the college level." Harmon (1979, p. 6) believed that behavioral theory "doesn't work when we're trying to teach college students to think or managers to make important planning decisions." In effect, the advocates of a cognitive educational perspective have proposed a stimulus-organism-response paradigm in which the organism (student) is recognized as having an active role in the process of learning and thinking.

Harmon's (1979) reference to "teaching college students how to think" has been the premise behind CPI. The recognition of the student's role in the learning process has raised the possibility of teaching students how to think and learn. For example, instructional design theorists such as Gagne and Briggs (1979) have suggested
indirect forms of cognitive instruction based on "favorable conditions" that provide students with opportunities for development of thought processes. As Gagne and Briggs (1979, p. 73) stated "in order to 'learn to think' the student must be given opportunities to think."

Proponents of CPI in higher education have proposed to directly teach cognitive/thinking processes. Lochhead and Clement (1975) described CPI as "an approach to teaching which emphasizes understanding, learning, and reasoning skills as opposed to emphasizing rote memorization of factual knowledge" (p. iii). CPI researchers propose that educators should be teaching students how to think and learn, not what to think and learn, emphasizing the process of learning, not the content (Lochhead, 1979). As Link (1980, p. 425) stated, "Thinking is not a consequence of learning, but its prime prerequisite."

In summary, this review indicates that an emphasis on the cognitive processes of all students has been shared by cognitive educational theorists (e.g. Gagne & Briggs, 1979; Harmon, 1979; Sprague, 1981) as well as CPI researchers. The primary difference between cognitive educational theorists and CPI researchers has been that the latter propose to directly teach cognitive processes, while cognitive educational theorists advocate a less direct approach through cognitive models of teaching. Another difference has been that most cognitive educational theorists have backgrounds in psychology and education, whereas CPI researchers in higher education have a distinctive multidisciplinary orientation. Most CPI researchers have had strong backgrounds in the "hard" sciences such as physics, engineering, mathematics, and computer science (Lochhead, 1979).
Consequently, their efforts have been aimed at researching and teaching the higher order thought processes that are necessary for their disciplines, e.g., logical thinking, abstract thinking, and conceptualization.

Current Methods of Cognitive Process Instruction

Lochhead (1979) divided CPI research in higher education into two general categories. The first category included courses designed to identify and improve problem solving skills. The second category included programs based on the developmental theory of Piaget. Examples of the problem solving and Piagetian-based methods will be presented and followed by a summary and critique of current CPI methods.

Problem Solving CPI. A program designed to teach problem solving skills to engineering students was developed by Woods, Wright, Hoffman, Swartman, and Doig (1975). Woods et al. (1975, p. 238) defined problem solving as "the activity whereby a 'best' value is determined for an unknown, subject to a specific set of conditions." In the 26 week program a professor attended classes together with a group of volunteer freshmen students in order to be exposed to the same content and instruction as the students.

A voluntary, non-credit, two-hour per week tutorial with the professor was utilized to discuss class material and homework and to develop problem-solving skills based on the following five step model: (a) Define, (b) Think about it, (c) Plan, (d) Carry out plan, and (e) Look back (see Table 1).
Table 1

Problem Solving Model (Woods, et al., 1975, p. 239)

<table>
<thead>
<tr>
<th>Define</th>
<th>Identify the actual problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Think about it</td>
<td>What are the attributes?</td>
</tr>
<tr>
<td>Collect info</td>
<td>Identify area of knowledge</td>
</tr>
<tr>
<td>Flowchart</td>
<td></td>
</tr>
<tr>
<td>Plan</td>
<td>Think up alternative plans</td>
</tr>
<tr>
<td>Translate</td>
<td>Solve</td>
</tr>
<tr>
<td>Carry out plan</td>
<td>Check reasonableness &amp; math</td>
</tr>
<tr>
<td>Look back</td>
<td>Check criteria &amp; constraints</td>
</tr>
<tr>
<td></td>
<td>Study related problems</td>
</tr>
<tr>
<td></td>
<td>Identify applications in</td>
</tr>
<tr>
<td></td>
<td>engineering, everyday</td>
</tr>
<tr>
<td></td>
<td>behavior &amp; deserted island</td>
</tr>
<tr>
<td></td>
<td>Identify &amp; memorize</td>
</tr>
<tr>
<td></td>
<td>order-of-magnitude numbers</td>
</tr>
<tr>
<td></td>
<td>Develop successive</td>
</tr>
<tr>
<td></td>
<td>approximation strategies</td>
</tr>
<tr>
<td></td>
<td>Study problem solving skills</td>
</tr>
<tr>
<td></td>
<td>learned</td>
</tr>
<tr>
<td></td>
<td>Communicate results</td>
</tr>
</tbody>
</table>

The tutorial sessions allowed the professor to learn how students solved problems, identify their difficulties, and help improve their problem solving approaches. Woods et al. (1975) believed that the tutorial activity (a) helped the students become proficient at identifying what they were doing and describing why they were trying to do it, and (b) helped the students become very aware of problem solving as an essential activity that can be improved. Woods et al. (1975) reported that the students were quite favorable toward the program.
Additionally, Woods et al. (1975) believed that the program helped the faculty become better teachers. However, due to various student difficulties (e.g. poor planning and time scheduling; difficulties in identification of major ideas, laws, and definitions) the authors believed that little skill in general problem solving had been gained through the educational program. Woods et al. (1975) intended to continue to teach the students explicit problem solving skills for the duration of the students' college careers, and to begin training new groups of freshmen students.

Another problem solving program was developed by Von Blum (1979) and associates to teach the "scientific method" to biology students. The scientific method employed in the study followed a five-step model: (a) observe, (b) develop an explanatory system, (c) formulate a tentative explanation, (d) make a specific prediction, and (e) test (see Table 2).

Von Blum (1979) stated that this model differed from other models of the scientific method because the explanations were derived from concepts and principles that were explicitly stated, rather than merely implied. The program was applied as a unit within an introductory biology course. In the unit, students used a written tutorial which presented a problem and guided the students in its solution via the scientific method as described by Von Blum (1979). A computer simulation was utilized to provide data for making observations, forming tentative explanations, and testing predictions regarding the problem. The 34 students in the experimental group were compared to 28 students in a control group who were instructed in the scientific
Table 2
Scientific Method Model (Von Blum, 1979)

<table>
<thead>
<tr>
<th>Observation</th>
<th>Which forms the basis for all explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory system</td>
<td>A formalization of pertinent, tested principles that have applied in the system to explain the phenomenon under consideration</td>
</tr>
<tr>
<td>Tenative explanation</td>
<td>A hypothesis derived from the explanatory system and the current observations</td>
</tr>
<tr>
<td>Specific prediction</td>
<td>A specific prediction or set predictions derived from the tenative explanation which are testable</td>
</tr>
<tr>
<td>Test</td>
<td>Evaluate and test the specific predictions</td>
</tr>
</tbody>
</table>

method using an alternative approach. Interviews and attitude questionnaires indicated that the students in the experimental group enjoyed the unit and considered the level of difficulty to be appropriate. There were no significant differences between the experimental and control groups on a posttest of written problems and a standardized set of test questions. However, the experimental group performed significantly better than the control group on transfer tasks requiring the application of scientific problem solving skills. Von Blum (1979) concluded that the experimental unit was superior to the control unit in helping students approach solutions to different transfer tasks.

A generic CPI approach to teaching problem solving skills was Whimbey's and Lochhead's (1980) workbook on problem solving and
analytical reasoning. The workbook was designed to help students develop the basic analytic and problem solving skills necessary for success in basic mathematics and science courses. The workbook has been used as a supplemental text in psychology, philosophy, reading, and education courses (Whimbey & Lochhead, 1980). The exercises in the workbook (e.g. word problems, figure and word analogies) were developed to be solved by students working as partners. The students have been encouraged to work through the exercises step by step with their partner in order to develop effective problem solving skills. Whimbey and Lochhead (1980) claimed that students who complete the exercises have shown improvement on scholastic aptitude tests such as the SAT or PSAT, in addition to developing the analytic thinking skills needed for studying mathematics and science.

Piagetian-based CPI. Perhaps the best example of the second category of CPI in higher education was the ADAPT program (Accent on Developing Abstract Processes of Thought) implemented at the University of Nebraska-Lincoln (Fuller, 1981). The ADAPT program was a Piagetian-based multidisciplinary program for freshmen which started in 1975. The program included courses in anthropology, economics, English, history, mathematics and physics and was designed to be a complete freshman year program. Fuller (1981) and his colleagues believed that as many as 50 percent of entering college freshmen were not reasoning at the formal operational stage theoretically expected of students their age. In a chapter of The ADAPT Book describing Piaget's theory as it applies to college teaching, Moshman (1981) wrote:
The construction of formal operational reasoning seems to be far from complete by the age of 14 or 15 but, rather, extends at least through the college years. Thus formal operational thinking should not be viewed as a description of the typical reasoning of college students but rather as an ideal toward which their cognitive development is tending. (p.8)

In response to the underdeveloped reasoning skills of college freshmen, the ADAPT curriculum was designed to promote reasoning as well as teach course content (Fuller, 1981). The ADAPT faculty modified a Piagetian-based classroom instruction strategy originally developed by Karplus (1974). The instruction strategy was called the Learning Cycle and was divided into three major phases: (a) Exploration, (b) Invention, (c) Application (see Table 3).

Table 3.

Learning Cycle (Fuller, 1981)

<table>
<thead>
<tr>
<th>Exploration</th>
<th>Following a brief statement of topic and direction, the students are encouraged to learn through their own experience by engaging in activities supplied or suggested by the instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invention</td>
<td>The concrete experiences of Exploration phase are used as the basis for generating concepts or inventing principles</td>
</tr>
<tr>
<td>Application</td>
<td>The students are given the opportunity to apply the generalized concepts or skills developed during the Invention phase</td>
</tr>
</tbody>
</table>

Although the ADAPT program was not developed for underprepared students, evaluations of the program suggested that many ADAPT students
were below average in cognitive developmental level as well as preparation for college work (Moshman, Johnston, Tomlinson-Keasey, Williams, and Eisert, 1981). Comparisons to control groups found that ADAPT students showed significantly greater gains in formal operational reasoning, conceptual complexity, critical thinking and more favorable attitudes toward faculty in at least one of the three years that evaluations were conducted (Moshman et al., 1981). Follow-up evaluations in the student's sophomore and junior years revealed numerous findings of no difference between ADAPT students and control groups (e.g. critical thinking in the junior year, college GPA); and, ADAPT students were more likely than controls to characterize their second year programs as high in difficulty (Moshman et al., 1981). Information on the attrition rates of ADAPT students was not given. Moshman et al. (1981) suggested that since ADAPT students, in general, were found to be academically below average upon their entry into college, the finding of no difference in GPA suggests that the ADAPT students may have at least gained average academic status.

The ADAPT program generated such enthusiasm in higher education that similar Piagetian-based programs have been started at many universities, colleges, and community colleges across the country. Examples are the DOMIS (Development of Reasoning in Science) program at California State University-Fullerton and Project SOAR (Stress on Analytical Reasoning) at Xavier University of Louisiana (Fuller, 1981). Programs such as Project SOAR have been created specifically to address the needs of underprepared students.
Summary and Critique

CPI in higher education has been a relatively new and expanding area. CPI programs may be divided into two general categories: problem solving CPI and Piagetian-based CPI. Evaluations of the programs have been generally favorable, but most of the research on CPI has been in the theoretical/developmental stages and firm evidence of success has not yet been established.

A critique of current methods of CPI in higher education with regard to underprepared students has both practical and theoretical components. These practical criticisms were based upon two considerations: first, the appropriateness of the program with underprepared students; second, that comprehensive and multidisciplinary "cognitive" programs require financial and personnel resources that many universities cannot or will not provide. These theoretical criticisms were largely based upon Feuerstein's (1979, 1980) theoretical conceptualization of cognitive development and learning.

Practical criticisms. Due to the diverse backgrounds of the researchers, the various problem solving CPI courses were usually subject-specific and did not provide a general model for CPI. In addition, most problem solving CPI courses were developed specifically for the sciences (with the possible exception of Whimbey and Lochhead's 1980 workbook) and were intended for the superior student. Consequently, problem solving CPI courses developed for engineering, biology, or even mathematics may have limited utility for underprepared students.
A practical problem in implementing a program such as ADAPT has been the comprehensive nature of the program. Students at the University of Nebraska should consider themselves fortunate to have faculty enlightened and interested enough to develop a multidisciplinary program such as ADAPT. Many colleges and universities do not have sufficient personnel or interest to implement such a broad-based program. Considerable expense has been involved in developing and implementing such comprehensive programs. Of the thirteen Piagetian-based programs listed by Fuller (1981), only one was started solely with internal institutional funds. That program, the STAR program (Metropolitan State College; Denver, CO), has since been eliminated.

A final practical criticism involved the motivation of students. Most problem solving and Piagetian-based CPI researchers seemed to expect students to be intrinsically motivated. As Maxwell (1979) pointed out, intrinsic motivation does not seem to be the norm, especially for underprepared students. Present CPI programs have not addressed the motivational aspect directly.

Theoretical Criticisms. A theoretical concern regarding problem solving CPI for underprepared students has been the lack of a consistent learning model. The problem solving CPI researchers universally rejected the behavioral, stimulus-response learning paradigm, which implies an adherence to a stimulus-organism-response paradigm. However, the problem solving CPI researchers did not appear to adopt a particular theory of intellectual development or teaching strategy. It should be noted that CPI researchers recognized this
criticism.

Most researchers in cognitive process instruction... accept the need for employing a variety of theories which may be incompatible with each other. They investigate psychological theories in terms of usefulness to education and they expect each theory to have a limited domain of application (Lochhead, 1979, p. 3).

Lochhead's (1979) perspective was appropriate, and perhaps preferable to other approaches, if the goal of the CPI program was to teach specific problem solving skills to specific groups of students (e.g. engineering students). If, however, the goal of the program was to develop cognitive processes which could be applied to various and unrelated academic areas, then most problem solving CPI programs were inappropriate.

Piagetian-based CPI programs attempted adherence to Piaget's developmental theory and the teaching strategies that have been derived from it. CPI programs such as ADAPT explicitly recognized the stimulus-organism-response (S-O-R) learning paradigm. Within the S-O-R learning paradigm, the teacher's role was defined as a stimulus source in the student's environment. Feuerstein (1980) has proposed an alternative learning paradigm in which the teacher's role is explicit and well defined. Feuerstein (1980) conceived a stimulus-(human)-organism-response learning paradigm in which the human (teacher) serves as a mediator and interpreter of the student's environment. From Feuerstein's (1980) perspective, the teacher serves as a mediator and interpreter of information, in addition to serving as a source of information. The role of the teacher as a mediator of
information was often implied in CPI literature, e.g., Fuller's (1981) director/facilitator role or Lochhead's (1979) tutor/coach role. However, only Feuerstein (1980) explicitly defined the role of the teacher as a mediator.

A final theoretical criticism concerned the level of the cognitive instruction. By definition, problem solving CPI was aimed at developing the complex cognitive skill of problem solving. Piagetian-based CPI was intended to develop thought processes at Piaget's formal operational level. Feuerstein (1980) has proposed that there are "prerequisites of thinking" that underlie formal operational thought, including complex cognitive skills such as problem solving.

These "prerequisites of thinking" were cognitive functions, which, Feuerstein theorized, were "building blocks" that must be established and applied before the learner is capable of higher order thought. Examples of cognitive functions were "systematic and precise data gathering" and "the ability to deal with two or more sources of information simultaneously" (Feuerstein, 1980, p. 71). From Feuerstein's theoretical perspective, cognitive functions such as those described above precede higher order thought processes and, if deficient, may interfere with thinking and learning at complex and abstract levels.

Application of Feuerstein's theory to underprepared college students suggested that many of these students may not be achieving satisfactorily due to deficient cognitive functions. Further, CPI efforts which have attempted to teach problem solving skills or formal operational thought may not have established the necessary prerequisite
cognitive functions needed for these complex cognitive skills.

Tenative criteria for underprepared student CPI. Drawing from the critiques of remedial education and CPI used in college settings, six tentative criteria for a CPI program for underprepared students were derived:

1. The program should be designed for underprepared students.
2. The program should be flexible enough to be applied as a course or courses within the traditional college curriculum and current remedial program.
3. The program should offer underprepared students the opportunity to develop both basic and complex thought processes.
4. The thought processes developed in the program should be generalizable to various academic areas and not subject specific.
5. The program should address the motivational issues regarding underprepared students.
6. The implementation of the program should be cost efficient.

The IE program designed by Feuerstein (1980) appeared to meet these six criteria. IE has not been applied to a college population in the United States, but has research to support its effectiveness and utility in other populations (Arbitman-Smith, Haywood, and Bransford, in press).

Feuerstein's Instrumental Enrichment

Feuerstein's IE was a CPI program which was originally designed for adolescents who have deficits in thinking skills that are necessary for adequate academic and social success. An outline of the theoretical foundations and goals of IE, a description of the IE instructional format, and the rationale for the use of IE with
underprepared college students will be presented. Due to the complex and comprehensive nature of Feuerstein's Theory, only those aspects of IE background and practice necessary for a basic understanding will be provided. For an in-depth, theoretical presentation refer to Feuerstein (1979, 1980).

Theoretical Foundations

Feuerstein, an Israeli psychologist, has developed his theory as a result of his work with the diverse populations which immigrated to Israel following World War II. In his work with these immigrants, Feuerstein became convinced that many of those individuals, classified as "retarded" by traditional psychometric instruments, were victims of the inadequacies of the instruments and the theoretical conceptions of intelligence which the instruments were designed to measure. Feuerstein believed intelligence was a dynamic entity open to modification and change, rather than a static quality as measured by traditional psychometric instruments and that it was closely related to what an individual was capable of learning, rather than what he or she had already learned. As a result of his dissatisfaction and the inadequacy of traditional psychometric instruments, Feuerstein (1979) developed the Learning Potential Assessment Device (LPAD), which was designed to assess the cognitive deficiencies of individuals. IE (Feuerstein, 1980) was developed as a method of remediating the deficiencies assessed by the LPAD. In the following excerpt, Feuerstein (1980) briefly described the ramifications of his conceptualization of intelligence.
The assumption that the human organism is open and amendable to change demands a very different method of assessment and evaluation, the purpose of which is to evaluate the individual's capacity to learn and, hence, to become modified. Thus, the purpose of assessment is to reveal the processes that may be impeding development. Treatment may then be directed at the correction of deficiencies, as a result of which the individual will be able to alter the course of his development. (p. 2)

Feuerstein proposed to change or modify the cognitive structure of individuals through the utilization of IE. Although it was not explicit in his writings, Feuerstein was referring to a physiological structural change when he wrote of cognitive structural change (D. L. Redfield, personal communication, September 1982). Thus, in Feuerstein's view, cognitive structure has a physiological base, and cognitive modification results in a permanent change in the cognitive structure of the individual.

Feuerstein's (1980) view that an individual's cognitive structure can be modified was titled Theory of Cognitive Modifiability. In turn, Feuerstein's theory of cognitive modifiability was based on his concept of "Mediated Learning Experience" (MLE). Feurstein believed that the cognitive structure of an organism may be developed through two modalities of interaction between the organism and its environment. The first modality involved direct exposure to sources of stimuli; the second involved mediated learning experience.
Direct exposure learning. Direct exposure to stimuli begins with birth and continues throughout the organism's lifetime. Feuerstein (1980) considered the direct exposure modality of learning to be consistent with the behavioral stimulus-response (S-R) learning paradigm and with Piaget's stimulus-organism-response (S-O-R) learning paradigm. In Feuerstein's view, the majority of what was learned in an individual's lifetime was learned through his or her direct exposure to stimuli. However, some individuals do not learn through direct exposure as efficiently as other individuals, although both may be exposed to the same stimuli. The differences between these individuals are due to the second modality of learning: mediated learning experience.

Mediated learning experience. Feuerstein (1980) believed that MLE is less universal than the direct exposure learning modality and limited to human learning. He described his concept of MLE in the following passage.

By mediated learning experience (MLE) we refer to the way in which stimuli emitted by the environment are transformed by a 'mediating' agent, usually a parent, sibling, or other caregiver. This mediating agent, guided by his intentions, culture and emotional investment, selects and organizes the world of stimuli for the child. The mediator selects stimuli that are most appropriate and then frames, filters and schedules them; he determines the appearance or disappearance of certain stimuli and ignores others. Through this process of mediation, the cognitive structure of the
child is affected. The child acquires behavior patterns and learning set, which in turn become modified through direct exposure to stimuli (Feuerstein, 1980, pp. 15-16).

Feuerstein (1980) stated that the concept of MLE could be expressed in a S-H-O-R paradigm, in which a human mediator (H) intervenes between the stimulus (S) and organism (O). The adoption of Feuerstein's perspective required a reconceptualization of individual differences in intellectual and cognitive development. In Feuerstein's (1980) theory, individual cognitive differences are not the direct result of differences in genetic makeup, or the amount of environmental stimulation. Rather, Feuerstein viewed individual cognitive differences as being a direct result of the quality and quantity of MLE the individual receives during their development.

The relationship between MLE and direct exposure learning may be described as follows: the capacity and efficiency of an individual's learning through direct exposure to stimuli was dependent on how early and how often an individual was subjected to effective MLE. Thus, the more and the earlier an individual was subjected to MLE, the greater would be his or her capacity to learn through direct exposure. Conversely, if an individual was subjected to ineffective or infrequent MLE early in his or her development, the less capable he or she would be in learning through direct exposure to stimuli.

Retarded performance. If individuals have been deprived of sufficient mediated learning experiences, their performance within their environment will be retarded. An important distinction with regard to terminology must be made here. Feuerstein did not use the word "retarded" to mean "mentally retarded" in the traditional sense.
He viewed the individual as a "retarded performer" because his or her performance was retarded, not the individual. Feuerstein's conceptualization of retardation was more than a semantic issue. As Feuerstein (1980, p. 36) explained it, "the effects of a lack of MLE may be conceptualized as depriving the individual of the prerequisites of higher mental processes, despite a potentially normal capacity inherent in him."

Cognitive functions. The "prerequisites of higher mental processes" that Feuerstein referred to were specific cognitive functions "that underlie internalized, representational and operational thought" (Feuerstein, 1980, p. 71). A lack, or insufficiency of MLE resulted in deficient cognitive functions which, in turn, were responsible for the retarded cognitive performance of the individual. Feuerstein (1980) has compiled a list of the deficient cognitive functions (Appendix A), but has made no claim that the list of deficient cognitive functions is either definitive or exhaustive, and he acknowledged that some overlap between deficiencies may exist. He stated that the list of deficient functions were "conceptualized for purposes of analysis, understanding of the underlying processes, and for didactic purposes" (p. 72).

Summary. To summarize and clarify Feuerstein's theory, it may be said that mediated learning experiences are aligned on a quantitative and qualitative continuum. Individuals on the upper end of the continuum, who have received sufficient and effective MLE, are more likely and more capable of learning through direct experience than individuals at the lower end of the continuum, who have received insufficient and ineffective MLE. In turn, the cognitive deficiencies
which result from a lack of sufficient and effective MLE are also a matter of degree, and not a "have" or "have not" proposition.

The idea that the cognitive structure of a retarded performer can be altered is important in understanding Feuerstein's (1980) theory. However, Feuerstein did not propose to create cognitive functions; rather, he proposed to remediate the cognitive functions that exist in almost every individual. In Feuerstein's view, the retarded performer possessed the capacity and potential for cognitive modifiability, and thus improved cognitive performance. The cognitive functions may be deficient, but the potential for modifiability does exist within the cognitive structure of the individual (Feuerstein concedes that organic damage may interfere with effective learning through direct experience, but he has maintained that a lack of MLE is the primary factor in retarded performance).

From Feuerstein's model, a CPI program would first have to remediate the deficient cognitive functions caused by a lack of MLE. As the deficient functions are corrected, the individual becomes capable of complex thought, such as abstract thinking, analytical reasoning, or problem solving. The role of IE may be described in another adaption of the S-O-R learning paradigm. The paradigm becomes S-H(IE)-O-R, in which IE is inserted to provide the MLEs which the individual lacks, thereby modifying the individual's cognitive structure, and remediating the deficient cognitive functions. The concept of mediated learning experience has been viewed as the primary foundation on which Feuerstein's theory of cognitive modifiability rests.
Goals of Instrumental Enrichment

The major goal of IE was to increase the capacity of the human organism to become modified through direct exposure to stimuli and experiences provided by the encounters with life events and with formal and informal learning opportunities (Feuerstein, 1980, p. 115).

This major goal involved increasing an individual's capacity to learn through direct experience. Six specific subgoals were outlined. These goals were:

1. the correction of the deficient cognitive functions of the individual.
2. the acquisition of basic concepts, labels, vocabulary, operations, and relationships necessary for doing IE lessons. Feuerstein believes that individuals must acquire these concepts if they are to think at the formal level and consider abstract relationships and rules.
3. the production of intrinsic motivation through habit formation. This goal is unique to the IE program. Habit was defined as an internal need system, and the habit of using higher level mental operations must be developed within the individual if he or she is to use these operations outside of the IE classroom.
4. the production of reflective, insightful processes in the student. This subgoal involved decreasing the impulsive thinking and behavior characteristic of the retarded performer and cultivating a reflective approach to problem solving.
5. the creation of task-intrinsic motivation. This subgoal requires
developing in an individual the intrinsic enjoyment of success in a
task for its own sake, without external reward or motivation to
succeed. Task-intrinsic motivation differs from intrinsic motivation
(Subgoal 3) in that intrinsic motivation is by definition an internal
need or habit to use higher order mental processes; task-intrinsic
motivation depends on the conscious enjoyment of challenging tasks.
6. the arousal of the learner from his or her role of passive
recipient and reproducer of information by changing the individual into
an active generator of new information. The role of passive recipient
and reproducer of information has been described somewhat derogatorily
as "memorization-regurgitation" learning. Feuerstein's goal was to
help the learner gather information and actively process it, and
thereby self-generate new insights, ideas, and information.
IE Instruction Format

The "instruments" used in the IE class are paper-and-pencil
exercises which are distributed to the class one sheet at a time.
There is a total of fifteen instruments consisting of more than 500
total pages of exercises. The IE program was designed to be used for
one hour lessons, three to five days weekly for approximately three
years. The instruments were designed for focus on specific cognitive
deficiencies and, in addition, to address many other prerequisites of
learning, such as reflective, insightful thought.

The typical IE lesson consists of six components:
(a) introduction, (b) independent work period, (c) discussion, (d)
summary, (e) principles, and (f) bridges. The introduction is used to
present the instrument to the students, define the applicable
vocabulary necessary to discuss the page, and to develop strategies for
solving the problems on the page. During the independent work period
the students solve the problems within the exercises while the teacher
circulates through the class checking for errors, focusing the
student's attention on the cognitive strategies and cognitive functions
necessary for successful completion, and helping those students who
experience difficulties with the page. The discussion is used to
discuss the problems the students had, the strategies they used to
complete the page, and to develop principles and bridges. A principle
is a general rule or statement which can be applied to many situations
and is drawn out of the exercise and discussion of the lesson. A
bridge is a concrete example or application of the principle. For
example, the principle for a page might be: It is necessary to
organize for efficiency, convenience, and understanding. Possible
bridges for this principle might be the development of a study plan to
organize a student's time; the establishment of priorities and personal
objectives in their life; or the observation that grocery stores and
libraries would be extremely inefficient without an organizational
system. Before the lesson is over the students and teacher summarize
the lesson, reviewing the principles and bridges developed, the
cognitive functions involved, and what has been learned in the lesson.

During each lesson the students are encouraged to consider their
own thinking processes and determine if their strategies are efficient
and effective in resolution of the exercise problems. If necessary,
the students are assisted in developing alternative strategies for
proper solution and in determining the specific cognitive functions
involved in a particular lesson. The principles and bridges are used
to demonstrate how the IE lesson may be applied outside the IE class,
especially in school, and within other aspects of the students' lives as well.

The flexibility of the IE program lies in the principles and bridges derived from a lesson. As the IE program progresses the students are expected to begin developing principles and bridges of their own. However, the teacher may direct the discussion toward a particular area, such as study skills or a specified content area.

Rationale for the Use of IE with Underprepared College Students

The major assumption underlying the use of IE in this study was that many of those students who enter college underprepared are "retarded performers" with regard to college academic performance. That underprepared students are "mentally retarded" in the traditional sense was not intended. Rather, in keeping with Feuerstein's definition, underprepared college students are often deficient in the cognitive functions which are the prerequisites for higher order thinking. Arons (1979), Fuller (1981), Tomlinson-Keasey and Eisert (1978), and Whimbey (1977) stated that higher order thinking (e.g. abstract thought, analytical reasoning, sequential thought) is necessary and expected in college, although they believed that as many as 50 percent of freshmen do not demonstrate these thought processes consistently. Feuerstein differed with them in his conception of prerequisites for higher order thought, the cognitive functions. In Feuerstein's theory the deficiencies in cognitive functions are a matter of degree. The average underprepared college student is almost certainly operating at a cognitive level sufficient for most nonacademic endeavors. However, underprepared college students are usually not operating at the cognitive level necessary to succeed in
college. It follows that specific academic skills such as math or reading are deficient, since, theoretically, the prerequisites for these higher order operations have not been established.

The rationale for the use of IE with underprepared college students has three aspects. The first involved a comparison of the characteristics of underprepared students with the characteristics of retarded performers which can be inferred from the goals and subgoals of IE. The second aspect concerned the emphasis on motivational factors in remedial programs shared by Feuerstein and remedial college educators. The third aspect was the theoretical potential of the IE program to improve thinking and learning processes in underprepared college students.

Characteristics. Underprepared college students have been described as follows. They have deficiencies in reading, writing, and arithmetic (Cross, 1976; Maxwell, 1979; Roueche & Snow, 1977). They have poor study habits (Cross, 1976; Maxwell, 1979; Roueche & Snow, 1977) and below average standardized test scores (Maxwell, 1979; Roueche & Snow, 1977). They tend to be impulsively disparaging of self, vulnerable to disparagement by others, lack insight about self, lack a clear set of personal goals and values, have frequent depressions, and are anxious (Maxwell, 1979). Underprepared students may lack proficiency or practice in analytical approaches to problem solving, have difficulties in working toward abstract goals or for symbolic rewards, and have a strong leaning toward the applied professions (Klingelhofer & Hollander, 1973). They have a poor self image (Cross, 1976; Roueche & Snow, 1977), an external locus of control, and are motivated primarily by external rewards (Maxwell,
Finally, they tend to be "dependent" learners who like to have tasks explained to them, rather than provide their own solutions (Cross, 1976).

Caution is necessary when generalizing across individuals. However, the uniformity in the descriptions of underprepared college students provided in the literature on remediation lends support to the list of characteristics provided here. In addition, the list helped in conceptualizing the enormous task of those educators working with underprepared students.

Retarded performers shared many of the characteristics of underprepared college students. Retarded performers have a history of low achievement in school and are deficient in many of the basic academic skills. They lack the basic concepts, labels, vocabulary, operations, and relationships necessary for the mastery of complex cognitive tasks. They lack an intrinsic need or motivation to use higher order mental processes such as abstract or evaluative thought. They tend to be impulsive, and not think reflectively or be insightful concerning their own thought processes or behavior. Retarded performers are externally motivated. They are passive recipients and reproducers of information. That is,

"he expresses himself as one who, at best, can perceive the stimuli and receive information and reproduce it, but who cannot produce new information by himself by using inferential thought processes in elaborating the data available to him" (Feuerstein, 1980, p. 280)

Feuerstein described the passive role as being one in which the retarded performers felt they were acted upon and could not take an
active role in their environment. As a result, the self-image of retarded performers suffers. Finally, the retarded performers have certain deficient cognitive functions due to a lack of effective mediated learning experiences. The commonality of the characteristics provided here served to highlight the similarities between "retarded performers" and underprepared college students.

Motivation. Cross (1976), Maxwell (1979) and Roueche and Snow (1977) emphasized that motivational factors must be considered when dealing with underprepared college students. The importance of motivation seems obvious when one considers that even "prepared" college students, with the necessary academic skills, will not succeed in college if they lack the motivation to succeed. Feuerstein recognized motivational factors and has attempted to provide motivational development within the IE program. Feuerstein proposed to produce intrinsic motivation through habit formation. Feuerstein intended to produce an internal need/habit to use and apply the thinking skills developed in the IE program. Feuerstein believed intrinsic motivation to use complex thinking skills was necessary because the external environment of the student often did not encourage or require the application of the skills. Task-intrinsic motivation was the second type of motivation Feuerstein intended to produce in the retarded performer. Task-intrinsic motivation may be generally described as enjoyment of a task for its own sake, outside of external reward for task performance. For this purpose, Feuerstein designed the IE instruments to be interesting and appealing, as well as purposeful and meaningful. It can be seen within the motivational context that IE may be especially applicable for underprepared college students.
Theoretical potential of IE. If deficient cognitive functions are considered causal factors in the underprepared college students' lack of academic success, then the reasons for their low achievement become more apparent. They lack the prerequisites for learning effectively through direct experience and instruction. Basically then, before they can learn, they must first learn how to learn. It was hypothesized that IE could improve thinking and learning skills in the college students who needed the improvement most, underprepared college students.

Although IE was originally designed for adolescent retarded performers, Feuerstein stated that IE is "accessible to, and useful to, a wide range of populations of levels, ages, and skills" (p. 290). Passow (1980), in an article describing IE wrote,

While the program was particularly designed to deal with adolescents who are retarded performers, the goals and processes are applicable to all learners, from young children to adults, whose lack of mediated learning experience and deficient cognitive functioning contributes to low performance. (pp. 396-397)

IE was designed to be used within the regular school curriculum. It was intended to supplement, rather than replace traditional educational instruction. The principles and bridges developed in an IE lesson can be directed toward the content area which is considered most important by a university faculty. For example, within a college setting the bridges or applications of the principles developed in class could focus on study skills. However, it is important to understand that the IE class would not necessarily teach study skills.
Rather, the IE class would help develop the prerequisite thinking processes necessary for understanding and applying specific study skills.

As a final point, the purpose of the program for underprepared students should be addressed. Cross (1976) distinguished between programs labeled "remedial" and "developmental" depending upon the purpose of the program. Remedial programs were described by Cross (1976) as those designed to overcome and correct academic weaknesses. Developmental programs would be those designed to "develop the diverse talents of students, whether academic or not" (Cross, 1976, p. 31). While IE has certainly been concerned with the "remediation" of cognitive deficiencies, from Cross' perspective, IE would be labeled as "developmental" in the broadest sense of the word.

**Summary**

Through the literature surveyed in this chapter, the writer has examined the prediction of college success; remedial education in higher education; cognitive process instruction in higher education; and the theoretical foundations, goals, and instructional format of IE. The rationale for the use of IE with underprepared college students has also been presented. The review was intended as an introduction and background to the specific areas necessary for understanding the hypothesis of this thesis, not as a comprehensive overview of the topics discussed.

The review of the literature revealed that as many as 90 percent of identified, underprepared college students fail to complete college. Although efforts in the prediction of college success have attempted to use non-intellective predictors such as personality and background
characteristics, standardized aptitude tests and high school GPA were regarded as the best single predictors. Standardized test scores were the most commonly used predictors.

Courses for remediation of academic deficiencies have been the primary educational response to underprepared students' difficulties in college. Remedial efforts at the college level have been generally unsuccessful, although the success of some programs suggest that underprepared students can be helped. College remedial educators recognized cognitive factors in the education of underprepared students; however, the possibility of increasing underprepared students' abilities to think and learn through CPI has been relatively unexplored.

Problem solving CPI approaches in higher education have been subject-specific and aimed at the average or superior student. Piagetian-based CPI programs required personnel and financial resources that many universities can not or will not provide. Both forms of CPI failed to address the basic processes that theoretically precede complex thought or explicitly define the role of the teacher as a mediator of information.

Feuerstein's IE was a CPI program that was designed for underprepared adolescent students, which could be applied within the traditional college curriculum. IE offered students the opportunity to develop both basic and complex thinking skills. IE was designed to generalize to various academic areas, address motivational issues, and be implemented on a cost-effective basis. However, IE has not been tested with a college population in the United States. Therefore, IE was a viable educational approach that could be used experimentally with underprepared college students.
Chapter III
Method
Setting of Study

This study was conducted at Western Kentucky University (Western), a public university located in Bowling Green, Kentucky. At the time of this study, Western had an open-admissions policy and an enrollment of approximately 12,000 students. All applicants for admission to Western's undergraduate programs (a) must have a high school diploma or high school equivalency degree and (b) must have taken the American College Test (ACT). Because of Western's open admissions policy, applicants are not rejected on the basis of ACT scores; rather, ACT scores are used for program planning purposes. Western officials have reported that as many as 60 percent of entering freshmen do not graduate from Western (R. Sutton, personal communication, June, 1982). This percentage included students who transferred to other universities. In an effort to maintain matriculation among students considered to be at relatively high risk for failure, Western offers remedial courses in English, Mathematics, Reading, and Psychology on a voluntary basis. Most of the remedial classes in the various disciplines are not coordinated through a central remedial program.

Subjects

The subjects for this study consisted of 65 undergraduate students enrolled in Western Kentucky University during the Fall 1981 semester. The age range was 17 to 28, with 94 percent of the subjects falling
between 17 and 19 years of age. As part of Western's normal registration process, entering students having composite ACT scores of below 16 and students who had experienced prior academic difficulty were advised to enroll in a remedial level psychology course entitled "Success Strategies." Enrollment in the course was strongly encouraged for those students identified as "underprepared." Underprepared was administratively defined as a student having an ACT composite score below 16. Students enrolled in the Success Strategies course (Psychology 050) were informed that they would not receive credit toward graduation for course completion. However, the students were informed that the remedial course grade would be used in determining their cumulative grade point average (GPA). Due to registration procedures, students enrolling in Psychology 050 were first assigned to the two sections that made up the control group. After the control sections were filled, students were assigned to the two sections of Psychology 050 that made up the experimental group. Because of the registration process, true random assignment of students to groups was not achieved.

**Design**

The study assumed a pretest-posttest control group design. During the Fall 1981 semester, 36 students enrolled in two sections of Psychology 050 were assigned to the control group; 29 students enrolled in two other sections of Psychology 050 were assigned to the IE experimental group. The control group received instruction in college success strategies, including study skills. One instructor was assigned to the two IE experimental sections. Two other instructors were assigned to teach the two control sections.
The independent variable was type of instruction (IE versus college success strategies, e.g., goal setting, decision making, and values clarification). The dependent variables were:

1. Changes in IQ as measured by the Lorge-Thorndike Intelligence Test, Nonverbal Battery, Level H, Form A (Lorge, Thorndike, & Hagen, 1966).

2. Changes in self-concept as measured by the Tennessee Self Concept Scale (Fitts, 1965).

3. Overall GPA for the Fall 1981 semester; GPA for the Fall 1981 semester after removing the effect of the grade obtained in Psychology 050; GPA for Fall 1981 semester after removing the effect of grades obtained in any remedial level class; and overall GPA for the Spring 1982 semester.


5. Descriptive data obtained from an experimenter-designed instrument developed to measure study habits.

6. Descriptive data obtained from an experimenter-designed course evaluation form.

**Instrumentation**

**Intelligence**

The Lorge-Thorndike Intelligence Test is a test of abstract intelligence which can be group-administered. The *Lorge-Thorndike Technical Manual* (Lorge et al., 1966 p. 1) defined abstract intelligence as "the ability to work with ideas and the relationships among ideas." Level H of the Multi-Level Edition was developed for high school seniors and college freshmen. The Nonverbal Battery was
provided to accompany the basic verbal series since the authors recognized that a verbal test may inadequately appraise some individual's abilities. The Nonverbal Battery consists entirely of pictorial, diagrammatic, and numerical items. Titles of the three subtests are figural analogies, figure classification, and number series (Lorge et al., 1966).

The odd-even reliability for Nonverbal, Level H raw scores was .90; alternative forms reliability for Nonverbal, Level H scores was .92; and the standard error of measurement at the 99 percent confidence level was ±3. The reported practice effect for Level H at about a one week interval was an average IQ gain of 4.37 points (Lorge et al., 1966).

Self Concept

The Tennessee Self Concept Scale (TSCS) consists of 100 self descriptive statements, is self-administering for individuals or groups, and can be used with subjects age 12 or older with at least a sixth grade reading level (Fitts, 1965). The total P (Positive) score is considered by Fitts (1965 p. 2) to be the most important score derived from the TSCS because it "reflects the overall level of self esteem." The effects of gender, age, race, level of education, and intelligence on the scores of the TSCS were demonstrated by Fitts to be quite negligible. The test-retest reliability for the total P score over a two week period was .92 (Fitts, 1965).

Grade Point Average

Four GPAs were obtained or calculated from university records for each student in the experimental and control groups: (a) overall GPA for the Fall 1981 semester; (b) GPA for Fall 1981 after removing the
effect of the grade obtained in Psycholog/ 050; (c) GPA for Fall 1981 after removing the effect of grades obtained in any remedial level class; and (d) overall GPA for the Spring 1982 semester. GPA data were obtained in order to determine if the independent variable had a significant effect on academic achievement level. The remedial course grades for the Fall 1981 GPA were removed in order to obtain a more accurate estimation of the students' academic achievement levels without the grade inflation anticipated from the remedial course grades.

Attrition Rates

The attrition rates were obtained from university records for students in the experimental and control groups. Attrition data were obtained because continued matriculation was viewed as an important success indicator of the remedial classes.

Study Habits

An experimenter-designed questionnaire was developed to gather descriptive data concerning study habits. The areas questioned included reading habits, attitudes toward reading, study habits, attitudes toward study, concept of study, and amount of time spent studying. No specific hypotheses were formed concerning the data obtained from the study habits questionnaire, which was used both pre and post treatment. The study habits questionnaire appears in Appendix B.

Course Evaluation

The course evaluation form was developed by the experimenter to gather information regarding the experimental group's attitudes toward IE instruction and the format of the class. Because IE had not
previously been used with a college population in the United States, the experimental group's reactions toward IE were considered to be especially important in order to facilitate the delineation and discussion of future research needs. An equivalent course evaluation form was developed for the control group. No specific hypotheses were formed concerning the data gathered by the course evaluation forms. The course evaluation forms appear in Appendix C.

**Analysis**

Description of the analysis has been divided into two sections. The first section describes the analyses of the quantitative data generated by the hypotheses concerning the IQ, self concept, GPA, and attrition variables. The second section describes the evaluation of the descriptive data gathered from the study habits questionnaires and course evaluation forms.

Enrollment in the Psychology 050 classes was not limited to beginning freshmen due to voluntary and open enrollment standards. Only those students who (a) were first semester freshmen and (b) had an ACT composite score below 16 were included in the attrition rate and GPA analyses. Only those students for which both pretest and posttest scores were available were included in the Lorge-Thorndike IQ and TSCS total P score analyses. Only those students who were enrolled in the experimental or control sections of Psychology 050 were included in the study habits and course evaluation analyses.

**Analyses of Quantitative Data**

In an effort to control for the average practice effect, 4.4 IQ points (Lorge et al., 1966) were subtracted from the posttest score
obtained by each subject. Following the adjustment for practice effect, the data were submitted to an Analysis of Covariance using the ANOVA subprogram of the Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975). The pretest scores of the Lorge-Thorndike functioned as the covariate. Analysis of Covariance (ANCOVA) was used to increase the precision of the analysis because of differences between the group means on the pretests. However, the group mean differences were not significant on the pretest.

Subprogram ANOVA of the Statistical Package for the Social Sciences (SPSS) was also used to conduct an analysis of covariance on the TSCS data. The pretest total P scores functioned as the covariate. Again, an ANCOVA was used to increase the precision of the analysis because of initial group mean differences, although the group mean differences were not significant.

The Fall 1981 GPA data were analyzed using a 2 X 3 analysis of variance (ANOVA) with repeated measures on the GPA variable. The ANOVA compared the experimental and control groups by overall GPA, GPA without the effect of the Psychology 050 course grade, and GPA without the effect of any remedial course grades.

A 2 X 2 ANOVA was used to compare overall Fall 1981 GPA and overall Spring 1982 GPA, between the experimental and control groups. In both analyses of variance, subjects in the control group were randomly deleted in order to provide equal sample sizes.

Attrition rate data for the experimental and control groups in the Spring 1982 and Fall 1982 semesters were analyzed using a 2 X 2 chi-square procedure. The chi-square analysis compared the
experimental and control groups' attrition rates across the two semesters.

Analyses of Descriptive Data

The study habits questionnaires (Appendix B) and course evaluation forms (Appendix C) were originally developed to gather information concerning underprepared students' study habits and attitudes toward IE instruction. Selected items were used for comparisons of the experimental and control groups and/or pre-test to post-test change for both groups. Three items from the study habits questionnaires (Items 4, 7, & 8), and two items from the course evaluation forms (Items 16 & 17) provided descriptive data which are presented descriptively in Appendix H7, H8, H9, I6, and I7. Analyses for seven items from the course evaluation (Items 1, 5, 6, 10, 11, 17, & 19) that the experimenter judged were of limited interest to readers outside of this study (e.g., How could your instructor improve?) were not presented in this thesis. The deleted items were used for information concerning follow-up IE research. All other items in the study habits questionnaires and course evaluations were analyzed using necessary and appropriate statistical procedures.

Procedure

In August 1981 the experimenter met with a faculty committee. The purpose of that committee was to determine the most appropriate application of IE to underprepared college students. The product of that meeting was a list of pertinent concepts and principles that the committee believed would be especially applicable to underprepared college students. The list of pertinent concepts and principles appears in Appendix D. Specific exercises from the first year IE
program were selected for purposes of teaching the concepts and principles generated by the experimenter and faculty committee.

The study was conducted during the first half of the Fall 1981 semester. The experimental and control classes (Psychology 050) each met for one hour, twice weekly for eight weeks. The first class period for all groups was used to acquaint the students with the availability of academic support services and to give a general introduction to the course as a course designed for teaching strategies necessary for success in college. The students were not informed that they would be pretested.

The second class period for all groups was used for pretesting. The Lorge-Thorndike Nonverbal Battery and TSCS were administered following the standardized procedures in the test manuals. The study habits pretest questionnaire (Appendix B) was distributed to the students at the end of the pretesting period. Students were instructed to complete the questionnaires and return them during the following class meeting. The students in all groups were told the testing was being conducted in order to evaluate the effectiveness of the course and would not affect their course grade. The test administrators were the experimenter and an experimenter-trained examiner who remained blind concerning the identity of the groups. Each test administrator tested one control section and one experimental section. The posttesting took place during the final class period in early October 1981. The students were informed that testing would be conducted during the final class period in order to evaluate the course and that the results would not affect their course grade. The experimenter-trained examiner and the experimenter conducted the
posttests. Each test administrator tested the control and experimental section which he had not tested in the pretest.

Course evaluation forms (Appendix C1) were completed by members of the experimental group during the class meeting prior to posttesting. The post-treatment study habits questionnaires (Appendix B2) were distributed during the next to the last meeting of the class in both the control and experimental groups and collected at the beginning of the posttesting period. Following completion of the course, it was determined that course evaluations by the students in the control group could prove useful for comparing the attitudes of the experimental and control groups toward the different types of instruction. A course evaluation equivalent to that used with the experimental group was designed (Appendix C2) and mailed to students in the control group. Twenty-one usable course evaluations were returned by students in the control group.

Treatment

Course grading criteria for both the experimental and control sections were equivalent; two-thirds of the grade was determined by attendance and the remaining third was determined by completion of homework and participation in classroom discussions and activities. Each of the two sections of the control group was taught by a different instructor; the experimenter taught both sections of the experimental group. A total of 16 hour-long class periods were available for instruction. After the introduction period and testing periods had been deducted from the total time available, approximately 12 to 13 hours of instruction had been conducted with the control and experimental groups.
The control groups classes were conducted primarily using a lecture format with some discussion of topics such as a goal setting, decision making, and values clarification. The experimental classes were discussion oriented and adhered to Feuerstein's emphasis on active participation and input by the students in the learning process. Because discussions in the experimental classes varied according to the student input, the topics and principles varied between the two sections of the experimental group. An outline of topics, principles, instrument pages, and homework assignments used for teaching the IE experimental classes appears in Appendix E.

The experimenter's qualifications to teach IE consisted of approximately 40 hours of training in the first year instruments and certification as a beginning level IE instructor. The experimenter had no previous formal teaching experience. The control group instructors were experienced teachers who had previously taught Psychology 050 to underprepared students.
Chapter IV

Results

The Results chapter will be divided into two sections. The first section presents the results of the quantitative data analyses; the second section presents the results of the descriptive data analyses.

Quantitative Data Analyses

Intelligence

The IQ test data obtained from pre and posttesting using Form A of the Nonverbal Battery of the Lorge-Thorndike Intelligence Test were submitted to Analysis of Covariance (ANCOVA) using subprogram ANOVA of the SPSS computer analysis program (Nie et al., 1975). An ANCOVA was used to increase the precision of the analysis because of group mean differences on the pretest. Only those students for whom both pretest and posttest scores were available (N=65) were included in the analysis. To control for average practice effect (Lorge et al., 1966), 4.4 IQ points were subtracted from the posttest score of each subject prior to analysis. A summary of the ANCOVA is presented in Table 4. Presented in Appendix F are the adjusted and unadjusted means and standard deviations of the pretest and posttest IQ scores for both groups.

Significant effects were found for the Covariate (F = 116.52; df = 1, 62; p<.01), indicating that the pretest covariate accounted for a significant amount of the total variance. No significant effects were found for Groups (F = .00; df = 1, 62).
Table 4
Lorge-Thorndike IQ Scores: Summary of Analysis of Covariance

<table>
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<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate</td>
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<td>7588.10</td>
<td>7588.10</td>
<td>116.52</td>
<td>.01</td>
</tr>
<tr>
<td>Main Effect (Group)</td>
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<td>.00</td>
<td>.00</td>
<td>.99</td>
</tr>
<tr>
<td>Error</td>
<td>62</td>
<td>4037.76</td>
<td>65.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>11625.86</td>
<td>181.65</td>
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<td></td>
</tr>
</tbody>
</table>

Tennessee Self Concept Scale Scores

The total P score data obtained from pre and posttesting with the TSMS were submitted to ANCOVA using subprogram ANOVA of the SPSS computer analysis program (Nie et al., 1975). Only those students for whom both pretest and posttest scores were available (N=65) were included in the analysis. A summary of the ANCOVA is presented in Table 5. Adjusted and unadjusted means and standard deviations for the experimental and control group pre and post total P scores are in Appendix G.

Significant effects were found for the Covariate (F = 60.09; df = 1, 62; p<.01), indicating that the pretest covariate accounted for a significant amount of the total variance. No significant effects were found for Groups (F = .10; df = 1, 62).
Table 5

TSCS Total P Scores: Summary of Analysis of Covariance

<table>
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<th>MS</th>
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<th>p</th>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>58052.13</td>
<td>907.06</td>
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<td></td>
</tr>
</tbody>
</table>

Grade Point Average

The GPA data for the Fall 1981 semester were analyzed using a 2 X 3 repeated measures ANOVA. The repeated measures or trials were
(a) overall Fall 1981 GPA (GPA); (b) GPA for Fall 1981 after removing the
effect of the grade obtained in Psychology 050 (GPAP); and (c) GPA for
Fall 1981 after removing the effect of grades obtained in any remedial
level class (GPAR). Only students who were first semester freshmen
with ACT composite scores of less than 16 enrolled in the experimental
and control sections were included in the analysis. Data were randomly
deleted from the control group data set in order to obtain an equal
sample size of 23 per cell.

A significant effect was found for trials ($F = 55.15; df = 2, 88; p < .01$). No significant effects were found for Groups ($F = .03;
df = 1, 43$) nor for the group by trials interaction ($F = .00; df = 2,
88$). A summary of the ANOVA results is presented in Table 6.
Using the Neuman-Keuls procedure for pairwise comparisons, post-hoc analysis revealed that control group GPAR was significantly lower than control group GPAP and control group GPA (p < .01); control group GPAR was also significantly lower than experimental group GPAP and experimental group GPA (p < .01); and experimental group GPAR was significantly lower than control group GPA and experimental group GPA (p < .01). The three measures of GPA for the experimental and control groups are depicted in Figure 1.

Table 6
Fall 1981 GPA: Summary of Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
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<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>.07</td>
<td>.07</td>
<td>.03</td>
<td>n.s.</td>
</tr>
<tr>
<td>Error</td>
<td>44</td>
<td>89.19</td>
<td>2.03</td>
<td></td>
<td></td>
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<tr>
<td>Within</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trials</td>
<td>2</td>
<td>3.64</td>
<td>1.82</td>
<td>55.15</td>
<td>.01</td>
</tr>
<tr>
<td>Groups by Trials</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
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<td>.00</td>
<td>.00</td>
<td>n.s.</td>
</tr>
<tr>
<td>Error</td>
<td>88</td>
<td>2.92</td>
<td>.03</td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>137</td>
<td>95.75</td>
<td></td>
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</tbody>
</table>

The GPA data from the Fall 1981 and Spring 1982 semesters were compared using a 2 X 2 repeated measures analysis of variance. The repeated measures were overall GPA for Fall 1981 (FGPA) and overall GPA for Spring 1982 (SGPA). Only students who were first semester freshmen
Figure 1
Mean GPA: Fall 1982 for Experimental and Control Groups

[Graph showing the comparison of Mean GPA between Experimental and Control groups]
with composite ACT scores of less than 16 were included in the analysis. Data were randomly deleted from the control group data set in order to obtain an equal sample size of 21 per cell.

A significant effect was found for trials ($F = 19.98; \text{df} = 1, 40; p < .01$). No significant effects were found for groups ($F = .05; \text{df} = 1, 40$) or group by trials interaction ($F = 1.48; \text{df} = -1, 40$). A summary of the ANOVA results is presented in Table 7.

Using the Neuman-Keuls procedure for pairwise comparisons, post-hoc analysis revealed that experimental group SGPA was significantly lower than experimental group FGPA ($p < .01$). No other pairwise comparisons were significant. The mean FGPA and SGPA for the experimental and control groups are illustrated in Figure 2.

Table 7

Fall 1981 and Spring 1982 GPA: Summary of Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>41</td>
<td>31.97</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
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<td>.04</td>
<td>.04</td>
<td>.05</td>
<td>n.s.</td>
</tr>
<tr>
<td>Error</td>
<td>40</td>
<td>31.93</td>
<td>.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within</td>
<td>42</td>
<td>18.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trials</td>
<td>1</td>
<td>10.39</td>
<td>10.39</td>
<td>19.98</td>
<td>.01</td>
</tr>
<tr>
<td>Groups by Trials Interaction</td>
<td>1</td>
<td>.77</td>
<td>.77</td>
<td>1.48</td>
<td>n.s.</td>
</tr>
<tr>
<td>Error</td>
<td>40</td>
<td>20.77</td>
<td>.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>50.81</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 2

Mean GPA: Fall 1981 and Spring 1982 for Experimental and Control Groups

---

Mean Grade Point Average

Experimental

Control

FGPA

SGPA
Attrition Rate

Attrition rate data were submitted to chi-square analysis. Only students who were first semester freshmen with composite ACT scores of less than 16 enrolled in the experimental and control sections were included in the analysis. The analysis used a 2 X 2 chi-square procedure. The two measures were the percentage of students from each group who were enrolled in the (a) Spring 1982 semester and (b) Fall 1982 semester. No significant effects were found in the attrition rate analysis ($\chi^2 = .026; df = 1$). A summary of the chi-square analysis is presented in Table 8.

Table 8
Attrition Rates: Chi-Square Summary

<table>
<thead>
<tr>
<th>Group</th>
<th>Spring, 1982 % enrolled</th>
<th>Fall, 1982 % enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>91.30</td>
<td>65.22</td>
</tr>
<tr>
<td>Control</td>
<td>93.94</td>
<td>63.64</td>
</tr>
</tbody>
</table>

($\chi^2 = .026, df = 1, n.s.$)

Descriptive Data Analyses

Study Habits Questionnaires

The study habits questionnaires (Appendix B) were analyzed item by item using procedures appropriate to each of the items. Only students who were enrolled in the experimental and control sections of Psychology 050 in Fall 1981 were included in the analyses. Sample size for the groups across items varies from item to item and pre to
posttesting due to incomplete responses and failure on the part of some students to return completed questionnaires.

**Pretest Item 1.** (Do you like to read?). The data obtained from item 1 were analyzed using a 2 (treatments) x 4 (response options) chi-square procedure. The response options were yes, no, sometimes, and no choice. Of the experimental group students, 16 responded yes, 6 responded no, 8 responded sometimes, and none responded no choice. Of the control group students, 16 responded yes, 5 responded no, 13 responded sometimes, and 1 responded no choice. No significant effects were found in the pretest Item 1 analysis ($\chi^2 = 1.90; df = 3$). A summary of the chi-square results is presented in Appendix H1.

**Pretest Item 2.** (Do you like to read for school?). The data obtained from item 2 were analyzed using a 2 (treatments) x 4 (response options) chi-square procedure. The response options were yes, no, sometimes, and no choice. Of the experimental group students, 6 responded yes, 11 responded no, 11 responded sometimes, and 3 responded no choice. Of the control group students, 6 responded yes, 14 responded no, 9 responded sometimes, and 2 responded no choice. No significant effects were found in the pretest Item 2 analysis ($\chi^2 = .76; df = 3$). A summary of the chi-square results is presented in Appendix H1.

**Pretest Item 3.** (Do you like to read for pleasure?). The data obtained from item 3 were analyzed using a 2 (treatments) x 3 (response options) chi-square procedure. The response options were yes, no, and sometimes. Of the experimental group students, 16 responded yes, 5 responded no, and 8 responded sometimes. Of the control group students, 22 responded yes, 3 responded no, and 7 responded sometimes.
No significant effects were found in the pretest Item 3 analysis \( (\chi^2 = 1.33; \text{df} = 2) \). A summary of the chi-square results is presented in Appendix H2.

**Posttest Item 1.** (Are you reading more or less than you did before entering college?). The data obtained from posttest Item 1 were analyzed using a 2 (treatments) X 3 (response options) chi-square procedure. The response options were more, less, and same. Of the experimental group, 18 responded more, 2 responded less, and 1 responded same. Of the control group, 23 responded yes, 3 responded no, and 3 responded same. No significant effects were found in the posttest Item 1 analysis \( (\chi^2 = .54; \text{df} = 2) \). A summary of the chi-square results is presented in Appendix H2.

**Posttest Item 2.** (Are you reading more less for school?). The data obtained from posttest Item 2 were analyzed using a 2 (treatments) X 3 (response options) chi-square procedure. The response options were more, less, and same. Of the experimental group students, 21 responded yes, none responded no, and none responded same. Of the control group students, 25 responded yes, 3 responded no, and 2 responded same. No significant effects were found in the posttest Item 2 analysis \( (\chi^2 = 3.88; \text{df} = 2) \). A summary of the chi-square results is presented in Appendix H3.

**Posttest Item 3.** (Are you reading more or less for pleasure?) The data obtained from Item 3 were analyzed using a 2 (treatments) X 3 (response options) chi-square procedure. The response options were more, less, and same. Of the experimental group students, 7 responded more, 11 responded less, and 3 responded same. Of the control group students, 9 responded more, 20 responded less, and 1 responded same.
No significant effects were found in the posttest Item 3 analysis ($\chi^2 = 2.33; \text{df} = 2$). A summary of the chi-square results is presented in Appendix H3.

Pretest Items 5 and 6, Posttest Item 5. (How many hours per week did you study in high school? How many hours per week do you anticipate studying in college? How many hours per week do you now study?) The data from pretest Items 5 and 6 and posttest Item 5 were analyzed using a 2 (treatments) X 3 (levels) repeated measures analysis of variance. The three levels were reported high school study hours (HS hrs); anticipated college study hours (AC hrs); and reported college study hours (RC hrs). Data were randomly deleted from the control group to obtain an equal sample size of 21 per cell. A summary of the ANOVA is presented in Table 9. Means and standard deviations for the study hours data are presented in Appendix H4.

Significant effects were found for Groups ($F = 8.81; \text{df} = 1, 40; p<.01$); Levels ($F = 19.20; \text{df} = 2, 76; p<.01$); and Interaction ($F = 26.6; \text{df} = 2, 76; p<.01$). The Neuman-Keuls post-hoc procedure was used to make pairwise comparisons of the significant findings.

Post-hoc comparisons revealed that experimental group AC hrs and RC hrs were significantly greater ($p<.01$) than HS hrs of either the control or experimental groups. The significant Interaction effect is accounted for by the significant difference between the control HS hrs and experimental AC and RC hrs. The study hours findings are depicted in Figure 3.
Table 9

Study Habits Pretest Items 5 & 6, Posttest Item 5: Summary of Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>377.18</td>
<td>377.18</td>
<td>8.81</td>
<td>.01</td>
</tr>
<tr>
<td>Error</td>
<td>40</td>
<td>1712.12</td>
<td>42.80</td>
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<td></td>
</tr>
<tr>
<td>Within</td>
<td>84</td>
<td>5552.67</td>
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<td></td>
<td></td>
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<tr>
<td>Levels</td>
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<td>1272.40</td>
<td>636.20</td>
<td>20.21</td>
<td>.01</td>
</tr>
<tr>
<td>Group by Levels Interaction</td>
<td>2</td>
<td>1762.26</td>
<td>881.13</td>
<td>27.99</td>
<td>.01</td>
</tr>
<tr>
<td>Error</td>
<td>80</td>
<td>2518.01</td>
<td>31.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
<td>7641.97</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pretest Item 7 and Posttest Item 6. (On a scale of 1 to 10, how much do you dislike studying?). The data from Items 7 and 6 were analyzed using a 2 X 2 analysis of variance with repeated measures on the dislike toward studying variable. Data were randomly deleted from the control group data set in order to obtain an equal sample size of 21 per cell. No significant effects were found for groups (F = .31; df = 1, 40); trials (F = 1.31; df = 1, 40); or the groups by trials interaction (F = .01; df = 1, 40). A summary of the ANOVA is presented in Appendix H5. Means and standard deviations for the study ratings are presented in Appendix H6.
Figure 3

Study Habits Pretest Items 5 & 6, Posttest Item 6: Mean Study Hours

[Diagram showing the mean study hours for experimental and control groups, with the y-axis labeled 'Mean Study Hours Per Week' and the x-axis labeled 'HS hrs, AC hrs, RC hrs.']
Pretest and Posttest Item 4. (What is study?). The data from this item were neither intended for, nor amenable to statistical analysis. The student responses were categorized according to the terminology used and concepts they represented. A percentage of student responses was tallied to determine each group's definition of study. For example, if an experimental group student had responded on the pretest, "study is when you read and try to understand the stuff for your classes," his or her response would have been tallied for read "read," comprehension "understand," and specific content "stuff for your classes," under the experimental pretest column of the percentage table. This tally/percentage procedure was also followed for the other solely descriptive items. Many of the definitional categories represent idiosyncratic responses by students on either the pretest or posttest questionnaires, e.g., increase IQ, meditation. The data obtained from Item 4 are presented in Appendix H7.

Pretest Item 8 and Posttest Item 7. (Describe how you study.). As with Item 4, the student responses were categorized according to the terminology used and concepts represented. The categorization of the responses followed the tally/percentage procedure described for study habits Item 4. The data obtained from Pretest Item 3 and Posttest Item 7 are presented in Appendix H8.

Posttest Item 8. (How have your attitudes toward studying changed?). In the experimental group, 17 of 21 (81%) reported some type of change in attitude toward study; 26 of 30 students (87%) in the control group reported some type of change in attitude toward study. The student responses were categorized according to the terminology used and concepts represented. The categorization of the responses
followed the same procedure described for study habits Item 4. The data obtained from Posttest Item 8 are presented in Appendix H9.

Course Evaluations

The course evaluation forms (Appendix C) were analyzed item by item as well as the study habits questionnaires. Only students who were enrolled in the experimental and control sections of Psychology 050 in Fall 1981 were included in the analyses. Sample size for the groups varies from item to item and pre to posttesting due to incomplete responses and failure on the part of some students to return completed course evaluations. Seven items from the course evaluations (Items 1, 5, 6, 10, 11, 17, and 19) were judged by the experimenter to be of limited interest to readers outside of the study; hence, analyses for these items are not presented in this thesis. The course evaluation items presented in this section were drawn from the control group evaluation forms (Appendix C2) because the terminology was more generic than the experimental groups forms.

Item 2. (On a scale of 1 to 5, with 1 being interesting and 5 being boring, Psychology 050 was:). The rating on Item 2 that the students provided was analyzed using a two-tailed t-test of independent group means. The obtained t-value failed to reach significance (t = .849; df = 47, p > .05). The means and standard deviations of the Item 2 ratings for the experimental and control groups are presented in Appendix II.

Item 3. (On a scale of 1 to 5, with 1 being hard and 5 being easy, understanding the concepts taught in Psychology 050 were:). The rating on Item 3 that each student provided was analyzed using a two-tailed t-test of independent group means. The obtained t-value
failed to reach significance ($t = 1.92; df = 47, p > .05$). The means and standard deviations of the Item 3 ratings for the experimental and control groups are presented in Appendix II.

**Item 4.** (On a scale of 1 to 5, with being hard and 5 being easy, Psychology 050 was:). The rating on Item 2 that each student provided was analyzed using a two-tailed t-test of independent group means. The obtained t-value failed to reach significance ($t = .75; df = 47, p > .05$). The means and standard deviations of the Item 4 ratings for the experimental and control groups are presented in Appendix II.

**Item 7.** (I believe I can apply some of the things I learned in Psychology 050 to other situations, yes or no?). The data obtained from Item 7 were analyzed using a 2 (treatments) X 3 (response options) chi-square procedure. The response options were yes, no, and no response. Of the experimental group students, 27 responded yes, none responded no, and 2 did not respond. Of the control group students, all 20 students responded yes. No significant effects were found in the Item 7 analysis ($\chi^2 = 1.45; df = 2$). A summary of the chi-square results is presented in Appendix II.

**Item 8.** (This class helped in my school work, yes or no?). The data obtained from Item 8 were analyzed using a 2 (treatments) X 3 (response options) chi-square procedure. The response options were yes, no, and no response. Of the experimental group students, 27 responded yes and 2 responded no. Of the control group students, 16 responded yes, 3 responded no, and 1 did not respond. No significant effects were found in the Item 8 analysis ($\chi^2 = 2.43; df = 2$). A summary of the chi-square results is presented in Appendix II.
Item 9. (I enjoyed this class, yes or no?). The data obtained from Item 9 were analyzed using a 2 (treatments) X 2 (response options) chi-square procedure. The response options were yes and no. Of the experimental group students, 28 responded yes and 1 responded no. Of the control group students, 19 responded yes and 1 responded no. No significant effects were found in the Item 9 analysis ($\chi^2 = .22; \text{df} = 2$). A summary of the chi-square results is presented in Appendix I3.

Item 12. (On a scale of 1 to 5, with 1 being interesting and 5 being boring, the class materials/activities were:). The ratings on Item 12 were analyzed using a two-tailed t-test of independent group means. The obtained t-value failed to reach significance ($t = .23; \text{df} = 45, p > .05$). The means and standard deviations of the Item 12 ratings for the experimental and control groups are in Appendix I4.

Item 13. (From which did you learn the most/least: discussions, class materials/activities, homework). Both groups ranked discussion first, class materials/activities second, and homework third. The means and medians of the student rankings for Item 13 are presented in Appendix I4.

Item 14. (I would recommend Psychology 050 to others, yes or no?). The data obtained from Item 14 were analyzed using a 2 (treatments) X 3 (response options) chi-square procedure. The response options were yes, no, and don't know. Of the experimental group students, 27 responded yes, none responded no, and 2 responded don't know. Of the control group students, 18 responded yes and 2 responded no. No significant effects were found for the Item 14 analysis ($\chi^2 = 4.28; \text{df} = 2$). A summary of the chi-square results is presented in Appendix I5.
Item 15. (If there were a follow-up to Psychology 050, would you take it?). The data obtained from Item 15 were analyzed using a 2 (treatments) X 4 (response options) chi-square procedure. The response options were yes, no, maybe, and no response. Of the experimental group students, 21 responded yes, 5 responded no, 2 responded maybe, and 1 responded don't know. Of the control group students, 13 responded yes, 5 responded no, and 2 responded maybe. No significant effects were found in the Item 15 analysis ($\chi^2 = 1.29; df = 3$). A summary of the chi-square results is presented in Appendix 15.

Item 16. (What would you change in course and what would you keep the same?). Item 16 was intended to provide the students with the opportunity to recommend changes in the course. Because the experimental group is the focus of the study, only data from the experimental group evaluations are described. As with prior descriptive items, the student responses are categorized according to the terminology used and the concepts represented. Approximately 76 percent of the students recommended some type of change. The data obtained from Item 16 are presented in Appendix 16.

Item 18. (How did the class help change the way you think and how you approach tasks?). Item 18 was intended to gather information regarding the students reactions to the IE instruction. Consequently, only data from the experimental groups course evaluations are reported. As with prior descriptive items, the student responses were categorized according to the terminology used and concepts represented. Of the experimental group students, 28 of 29 reported some type of change in thinking. The data obtained from Item 18 are presented in Appendix 17.
Chapter V
Discussion and Summary

Primary Hypothesis

The purpose of this study was to investigate the potential of IE for successful use as a cognitive educational intervention program with underprepared college students. The primary hypothesis stated that IE would enhance the thinking and learning skills of underprepared college students, and thereby increase their abilities to achieve satisfactorily in college. Four specific secondary hypotheses were developed in order to test the primary hypothesis. The secondary hypotheses build upon one another and will be restated as they are discussed.

This chapter is divided into three sections. The first section contains a discussion of the results concerning the four secondary hypotheses. The second section is a condensation and presentation of the descriptive data obtained from the study habits questionnaires and course evaluation forms. The third section is a summary of the results and implications for future research.

Secondary Hypotheses

Hypothesis 1. Compared to the control group, the IE experimental group will demonstrate significantly greater abilities to think and reason as measured by the Nonverbal Battery of the Lorge-Thorndike Intelligence Test.
The covariate effect for the Lorge-Thorndike ANCOVA was significant. This finding indicated only that the pretest covariate and posttest scores were highly correlated and that the pretest covariate accounted for a significant amount of the total variance. The group effect, which was addressed in hypothesis one, was not significant. Thus, the findings of the Lorge-Thorndike analysis did not support hypothesis one. There are three interpretations that separately or together may account for the finding of no significant between group differences on the Lorge-Thorndike:

1. IE, as it was applied in this study, is not a valid or effective method of bringing about changes in thinking and reasoning abilities for underprepared college students.

2. The duration of the IE treatment was insufficient to produce the hypothesized changes.

3. The Nonverbal Battery of the Lorge-Thorndike was not sensitive to changes that resulted from the IE treatment.

Hypothesis 2. Compared to the control group, the IE experimental group will demonstrate a significantly improved self concept as measured by the TSCS.

The covariate effect for the TSCS ANCOVA was significant. This finding indicated only that the pretest covariate and posttest scores were highly correlated, and that the pretest covariate accounted for a significant amount of the total variance. The group effect, which was addressed in hypothesis two, was not significant. Thus, the findings of the TSCS analysis did not support hypothesis two. There are three interpretations that separately or together may account for the finding of no difference between groups on the TSCS:
1. Positive changes in thinking and reasoning did not occur, thus the students did not perceive themselves differently.

2. The duration of the IE treatment was insufficient to produce the hypothesized changes.

3. The TSCS was not sensitive to changes that resulted from the IE treatment.

Hypothesis 3. Compared to the control group, the improved thinking skills of the IE experimental group will be reflected in a significantly higher grade point average in the Fall 1981 semester, and the Spring 1982 semester.

The first GPA analysis used three measures derived from the Fall 1981 GPA data: (a) overall GPA; (b) GPA with the Psychology 050 course grade removed; and (c) GPA with all remedial level course grades removed. The ANOVA indicated that there were no significant GPA differences between groups, thus, hypothesis three was not supported. However, there was a significant effect across the three measures of GPA. The Fall 1981 GPA findings indicated that the inclusion of remedial course grades had a significant additive effect upon GPA across groups. While these findings are not directly related to the research question, they do have implications for college remedial programs as well as raise questions about grade inflation.

If the remedial courses serve only to inflate the GPA of underprepared students, then the purpose and goals of these programs will not be met. However, if the remedial courses provide the underprepared students with an introduction and gradual assimilation into college-level coursework, while remediating the students' deficiencies, then the purpose and goals of the remedial program may be
fulfilled. The data from this study indicate that remedial courses inflated overall GPA for underprepared students. Whether the students were helped by this grade inflation is unlikely.

The second GPA analysis compared the overall Fall 1981 GPA and overall Spring 1982 GPA between the experimental and control groups. No significant effect was found for groups; thus, hypothesis three was again not supported. However, there was a significant effect for measures of GPA. The post-hoc comparisons revealed that the Spring GPA of the experimental group was significantly lower than the Fall GPA for the experimental group. The GPA of the control group also declined substantially from the Fall to the Spring semesters, but the decline for that group was not significant. The finding of a significant decline for experimental group GPA from the Fall to Spring semesters, but not for the control group, was the reverse of the hypothesized result. There are five interpretations that separately or together may account for the results of the GPA analyses findings:

1. The IE treatment did not bring about changes in thinking and reasoning, thus there was no positive effect upon academic achievement levels.

2. The IE treatment actually had a negative effect upon the experimental group students with regard to achievement.

3. The control treatment provided needed directive help in college "survival skills" which the students in the experimental group did not receive through IE instruction.

4. The finding was due to extraneous variables and not directly attributable to the independent variable.

5. The Spring 1982 mean GPA across groups was significantly lower
than the Fall 1981 mean GPA because the Spring GPA had not been inflated by remedial course grades.

With regard to the GPA analyses findings, it should be noted that the GPA of both groups declined when remedial course grades were removed. GPA for both groups declined also from the Fall to Spring semesters. Significant GPA differences were across groups, not between groups.

Hypothesis 4. Compared to the control group, the improved thinking skills and higher grade point average of the IE experimental group will result in a significantly lower attrition rate in the Spring 1982 and Fall 1982 semesters.

The attrition rates for the experimental and control groups were compared for the Spring and Fall semesters of 1982. No significant effect was found for groups, consequently, hypothesis four was not supported. An interesting finding was that although more than 90 percent of the students returned for the Spring 1982 semester; only 65 percent of the experimental group and 63 percent of the control group were enrolled at Western in the Fall 1982 semester. This 65 percent matriculation rate is higher than Western's average matriculation rate of 40 percent over four years; but it remains to be seen if there will be further attrition over the next three years.

The explanation for the current attrition rate finding is dependent on the previous findings for GPA. Simply stated, many of the underprepared students in both groups were apparently failing in their regular coursework; therefore, they did not return for the Fall 1982 semester. There are two interpretations that separately or together may account for the results of the attrition rate analysis:
1. The IE treatment did not result in changes in thinking skills or academic achievement levels; thus, there was no effect upon attrition rates.

2. The duration of the IE treatment was insufficient to bring about the changes necessary to have a significant effect on the attrition rate of the experimental group.

Descriptive Data

The discussion of the descriptive data will be divided according to the source of the data: study habits questionnaires and course evaluation forms. The only significant difference between groups involved the number of study hours per week and will be discussed first. The data from the study habits questionnaires will be used to form a description of study habits and attitudes toward study for students in both groups. The data from the course evaluations will be used to describe the experimental group students' reactions to IE instruction, and control group students' reactions to the Psychology 050 course as it was taught.

Study Habits Questionnaires

The only significant finding concerned the number of weekly study hours reported for high school, anticipated college study hours, and those college study hours reported on the posttest. Across the three levels of study hours, the experimental group anticipated and reported studying more hours per week than did the control group. Taken separately, the reported number of weekly college study hours for each group was not significantly different, according to the post-hoc comparisons.
No other between group comparisons on the study habits data were found to be significant; consequently, the reasons for a difference on the study hours dimension are not clear. Three possible explanations are: (a) in light of the GPA findings reported previously, the experimental group may have found it necessary to study more; (b) the experimental group students may have applied themselves more diligently to their studies; and/or (c) the differences may be due to extraneous variables and not directly attributable to the independent variable.

Students in both groups had mixed attitudes toward reading. At least 55 percent of students in both groups liked to read for pleasure, but only 21 percent of the students in the experimental group and 17 percent of the students in the control group liked to read for school. This may be an unfortunate attitude, since at least 83 percent of students in both groups reported on the posttest questionnaires that they were reading more for school than at the beginning of the semester.

Neither group of students revealed a strong opinion concerning their feelings toward studying. The mean ranking of dislike toward studying on a 1 to 10 scale was between four and five for both groups, on both the pretest and posttest questionnaires. A ranking of five on a 1 to 10 scale would usually be considered "no opinion."

There was no clear-cut concept by either group about the meaning of "study." Learning was the most frequently mentioned term in the students' definitions, with content being the second most frequent response. Students in both groups appear to have a vague understanding of what it means to study.
Consistent with their diverse understanding of the concept of study, students in both groups mentioned a variety of methods when describing how they study. The most frequently mentioned method was reading, but was mentioned by no more than 59 percent of the students in either group. The students' study methods usually lacked organization, and only one student in each group mentioned a specific study procedure (SQ3R). Despite their generally poor study habits, many of the students responding on the posttest questionnaire commented on the importance and necessity of studying in college.

Course Evaluations

The majority of the students in the experimental group and the control groups found their instruction to be interesting. Understanding the concepts presented in class was somewhat more difficult for the students in the experimental group than for those in the control group. The greater difficulty in understanding the class concepts may reflect the abstract nature of IE instruction. Neither group considered their respective courses to be difficult. Both groups believed they could apply the principles learned in class to other non-educational situations. Ninety-three percent of the students in the experimental group and 80 percent of the students in the control group reported that the course had helped in their schoolwork. Only one student in each group reported that they did not enjoy the course.

Neither group expressed a strong opinion concerning the materials used in class. At least four students in the experimental group were unhappy with the IE worksheets and considered them to be too simple. Both groups reported that they learned the most from class discussion, with class materials ranked second and homework third. More than 90
percent of the students in both groups reported that they would recommend the course to others. Seventy-two percent of the students in the experimental group and 65 percent of the students in the control group reported that they would take a follow-up course if it were offered.

Seventy-five percent of the students in the experimental group recommended some type of change in the course. The three most frequent suggestions were to (a) discard or change the IE worksheets, (b) expand the class to a full semester, and (c) have more discussion. In the experimental group, 28 of 29 students reported that the class had helped change the way they think and approach tasks. The factors that emerged most frequently in the experimental group responses were greater efficiency and less impulsivity in their task approaches.

Summary

This study has investigated use of Feuerstein's Instrumental Enrichment program with underprepared college students. Four specific secondary hypotheses were formulated in order to test the primary hypothesis of enhanced thinking and learning skills for underprepared college students through the use of IE. Analysis of the dependent variables drawn from the secondary hypotheses revealed (a) no significant group differences on the Nonverbal Battery of the Lorge-Thorndike Intelligence Test; (b) no significant group differences on the TSCS total P score; (c) no significant group differences for two analyses of GPA; and (d) no significant differences between groups in attrition rate across two semesters.

Data gathered from study habits questionnaires were also analyzed for group differences. The only significant difference between groups
indicated that the experimental group anticipated and reported studying more hours per week in college than did the control group. Descriptive data suggested that most of the students in both groups are ambivalent toward study; are limited in their understanding of the meaning of study; are not efficient or effective in their study habits; but are aware of the need to study in college.

Data gathered from course evaluation forms indicate that students in both groups found the classes to be relatively easy, enjoyable, and useful. The majority of the students in the IE experimental group report that IE instruction has been interesting and that their thinking and approach to tasks changed due to the IE intervention. Most students would be interested in a follow-up course, if available; a small number of students in the experimental group considered the IE worksheets to be too simplistic.

Conclusion. The findings of this study do not support the primary hypothesis—namely, that IE would enhance the thinking and learning skills of underprepared college students and, thereby, increase their abilities to achieve satisfactorily in college. One or more of the following three interpretations may account for the finding of no treatment effect:

1. IE, as it was applied in this study, is not a valid or useful cognitive educational intervention with underprepared college students.

2. The duration of the IE treatment was not sufficient to produce the hypothesized changes in thinking and learning skills.

3. The evaluation instruments used in the study were not sensitive to changes in the experimental group students, if in fact changes did occur.
The acceptance or rejection of any of these interpretations without further research would be premature and speculative. It should be noted that the original premise behind the use of IE with underprepared college students was supported. Namely, that many underprepared students function as retarded performers with regard to college academic performance. Deficits in achievement, motivation, and academic skills are apparent in the data gathered during this study. Although the use of IE as a cognitive educational intervention was not supported in this study, many questions remain unanswered. The following section addresses the implications for future research.

**Implications**

1. Future research should investigate whether increased duration of treatment will result in the cognitive changes hypothesized for the IE program. Those individuals currently engaged in IE research believe that a minimum of 30 hours of IE instruction must be conducted in order to begin cognitive change (D.L. Redfield, personal communication, October 1982). Thus, it is suggested that further use of IE with college students should be extended to at least a full semester course.

2. Future research should apply or develop evaluation instruments that are more sensitive to, and appropriate for, the hypothetical effects of IE. For example, self concept may be changed through IE instruction, but the change may be too subtle and slow for accurate assessment in a short term, pre-post study. Additionally, appropriate evaluation instrumentation has been one of the primary methodological problems in prior IE research (R. Arbitman-Smith, IE workshop, March 1982). Appropriate evaluation instrumentation might include measures of (a) critical thinking, (b) formal-operational thought, (c) problem
solving, (d) analytic/evaluative thought, (e) reflective versus impulsive task approach, (f) locus of control, and/or (g) attribution.

3. Future IE research with underprepared college students should look carefully at the possibility of a "survival skills" issue. That is, underprepared students may need to be instructed in basic study techniques and social skills in order to "survive" their first academic year before they are exposed to a cognitive educational program.

4. Future research should consider combining IE instruction with more "traditional" remedial courses. It is suggested that basic "survival" skills are needed to achieve even marginally in college, and that higher order cognitive skills are necessary to successfully complete college. A multidimensional course or courses would be consistent with the emphasis placed on remedial programs by Cross (1976) and Roueche and Snow (1977). The IE course could be coordinated with a study skills course that applied the principles developed in IE, e.g., planning, organization, orientation.

5. Future research with college students should select a wider variety of IE instrument pages, or develop alternative strategies. The concepts and principles discussed at the first year IE level were not too simplistic for the underprepared college students, but some students regarded the instrument pages as childlike or patronizing. Carefully selected pages from the second and third year IE instruments would prove more appropriate with college students. Another alternative is to use the IE instructional format in a "content" course (e.g., English, math, psychology) and use the course material rather than the regular IE instruments to build principles and bridges.
6. Regarding the GPA findings, future research and programs in the college remedial field should carefully consider the purpose, goals, and effectiveness of the remedial program. If the remedial classes serve only to inflate the GPA of underprepared students, the remedial program may be providing underprepared students with unrealistic expectations about college coursework.

7. Finally, in future research with underprepared college students, alternative CPI methods for implementation or comparison with IE instruction may need to be considered.
References


Appendices
Appendix A
Appendix A

Deficient Cognitive Functions (Feuerstein, 1980)

Input:
1. Blurred and sweeping perception
2. Unplanned, impulsive, and unsystematic exploratory behavior
3. Lack of, or impaired, receptive verbal tools and concepts which affect discrimination
4. Lack of, or impaired, spatial orientation, including the lack of stable systems of reference which impair the organization of space
5. Lack of, or impaired, temporal orientation
6. Lack of, or impaired, conservation of constancies (i.e., in size, shape, quantity, orientation) across variations in certain dimensions of the perceived object
7. Lack of, or deficient need for, precision and accuracy in data gathering
8. Lack of, or impaired capacity for considering two sources of information at once, reflected in dealing with data in a piecemeal fashion rather than as a unit of organized facts

Elaboration:
1. Inadequacy in experiencing the existence of an actual problem and subsequently defining it
2. Inability to select relevant, as opposed to irrelevant, cues in defining a problem
3. Lack of spontaneous comparative behavior or limitation of its appearance in a restricted field of needs
4. Narrowness of the mental field
5. Lack of, or impaired, need for summative behavior
6. Difficulties in projecting virtual relationships
7. Lack of orientation toward the need for logical evidence as an interactional modality with one's objectal and social environment
8. Lack of, or limited, interiorization of one's behavior
9. Lack of, or restricted, inferential-hypothetical thinking
10. Lack of, or impaired, strategies for hypothesis testing
11. Lack of, or impaired, planning behavior
12. Non-elaboration of certain cognitive categories because the necessary labels either are not part of the individual's verbal inventory on the receptive level or are not mobilized at the expressive level

Output:

1. Egocentric communicational modalities
2. Blocking
3. Trial and error responses
4. Lack of, or impaired, verbal tools for communicating adequately elaborated responses
5. Deficiency of visual transport
6. Lack of, or impaired, need for precision and accuracy in communicating one's response
7. Impulsive acting-out behavior, affecting the nature of the communication process
Appendix B
Appendix B1

Pretest Study Habits Questionnaires

Study Habits

Name:

(1) Do you like to read?
(2) for school?
(3) for pleasure?
(4) What is study?

(5) How many hours per week did you study in high school?

(6) How many hours per week do you anticipate studying in college?

(7) On a scale of 1 to 10, how much do you dislike studying?

Like 1 2 3 4 5 6 7 8 9 10 Dislike

(8) Describe how you study:
Appendix B2

Posttest Study Habits Questionnaire

STUDY HABITS

Name:

(1) Are you reading more or less than you did before entering college?

(2) Are you reading more or less for school?

(3) Are you reading more or less for pleasure?

(4) What is study?

(5) How many hours per week do you now study?

(6) On a scale of 1 to 10, how much do you dislike studying?

   Like  1 2 3 4 5 6 7 8 9 10  Dislike

(7) Describe how you study:

(8) How have your attitudes toward studying changed?
Appendix C1

Experimental Group Course Evaluation Form

COURSE EVALUATION 050

(1) My reasons for taking this course are:

(2) This course has been:

- interesting 1 2 3 4 5 boring

(3) Understanding the concepts in class was:

- hard 1 2 3 4 5 easy

(4) This class was:

- hard 1 2 3 4 5 easy

(5) I found it hard to participate in class discussions. If yes, why? If no, why not?

(6) The homework had little to do with the class. True or False. Why or why not?

(7) I believe I can apply some of the principles learned in this class to other situations. If so, how?

(8) This class has helped in my school work. True or False. Why or why not?

(9) I've enjoyed this class. Yes or No. Why or why not?

(10) The instructor was:

- well-prepared 1 2 3 4 5 underprepared

(11) The instructor had a good grasp of the information. Yes or No? Why or why not?

(12) The worksheets were:

- interesting 1 2 3 4 5 boring
(13) Rank these depending on which you learned the most from:

- discussions
- worksheets
- homework

(14) I would recommend this course to others. Why or why not?

(15) If there were a follow-up to Instrumental Enrichment, would you take it? Why or why not?

(16) What would you change in the course and what would you keep the same?

(17) How could your instructor improve?

(18) How did the class help change the way you think and how you approach tasks?

(19) Additional Comments:
Appendix C2

Control Group Course Evaluation Form

COURSE EVALUATION PSYCHOLOGY 050

(1) What were your reasons for taking Psychology 050?

(2) On a scale of 1 to 5, (1=interesting; 5=boring) Psychology 050 was:

   interesting 1 2 3 4 5 boring

(3) On a scale of 1 to 5, (1=hard; 5=easy) understanding the concepts taught in Psychology 050 was:

   hard 1 2 3 4 5 easy

(4) On a scale of 1 to 5, (1=hard; 5=easy) Psychology 050 was:

   hard 1 2 3 4 5 easy

(5) I found it hard to participate in class discussions. If yes, why? If no, why not?

(6) The homework had little to do with the class. Yes or No? Why or why not?

(7) I believe I can apply some of the things I learned in Psychology 050 to other situations. Yes or no? Why or why not?

(8) This class helped in my school work. Yes or no? Why or why not?

(9) I enjoyed this class. Yes or no? Why or why not?

(10) On a scale of 1 to 5, (1=well-prepared; 5=unprepared) the instructor was:

   well-prepared 1 2 3 4 5 unprepared

(11) The instructor had a good grasp of the information. Yes or no? Why or why not?
(12) On a scale of 1 to 5, (1=interesting; 5=boring) the class materials/activities were:

interesting 1 2 3 4 5 boring

(13) From which did you learn the most:

discussions
class materials/activities
homework

From which did you learn the least:

discussions
class materials/activities
homework

(14) I would recommend Psychology 050 to others. Why or why not?

(15) If there were a follow-up to Psychology 050, would you take it? Why or why not?

(16) What would you change in the course and what would you keep the same?

(17) How could your instructor improve?

(18) How did the class help change the way you think and how you approach tasks?

(19) Additional comments:
Appendix D
Appendix D

Committee Meeting List of Principles

I. Organization

A. Time—how to use it effectively
B. Resources—how to identify them, how to use them
C. Goals—establish priorities
D. Life in general—Where have you been? Where are you going? Where are you now? (Also touches on orientation)
E. Environment—room, car clothes, etc.
F. Homework and classes
G. Work, tasks, and study

II. Orientation

A. Information—Do you seek it out? Receive it only? Process it? Evaluate it? Ignore it? What kind of information? How does it relate to you?
B. Friends—Where do you stand? How do you relate to them? At what level?
D. Perceptions of others—Friends, parent, classmates, instructors; emotional reactions to them both positive and negative; social skills
E. College environment—Why are you here? What purpose? Where do you fit in? What is relevance to your world? What do you hope to accomplish (goals)?
F. Strangers—There are many of them on campus, both students and instructors. Can you change that orientation to make them friends?

G. World and Society—Your culture, are there other cultures? Where are you in relation to them? Can they be explored? Can they be incorporated?

H. Reading and information gathering—Sometimes for pleasure; sometimes for information and content; sometimes (and often) outside of classroom

I. Student as learner and teacher—Can you be a resource, help someone?

J. Campus—How do you get around?

III. Comparisons

A. Similarities and Differences
   1. to other people
   2. to life in college and life at home (homesickness?)

B. Motivation—Intrinsic vs. extrinsic

C. Information
   1. general vs. specific
   2. relevant vs. irrelevant
   3. important vs. unimportant

D. Goals—Long-term vs. short term

E. Likes and Dislikes
   1. people
   2. classes
   3. instructors
   4. activities
IV. Analysis

A. Analytical reasoning
   1. analogies
   2. relationships
   3. again similarities and differences

B. Logical Thought
   1. deductive and inductive
   2. logical progression from one idea/task to another
   3. sequencing

C. Problem solving
   1. identification of problem/task/goal
   2. generation of alternatives, strategies, possible solutions, brainstorming
   3. decision making--deciding among alternatives, relevant and irrelevant information, correct and incorrect, realistic and unrealistic
   4. implementation--strategy is used
   5. evaluation of decision and process

D. Need for precision in identification, communication, and problem solving in order to be effective

E. Relevant and irrelevant information and considerations

F. Critical Thinking--evaluation and analysis

G. Hypothetical Thinking--if this, then what?
Appendix E

Course Outline for Experimental Group

Note: The following is a generalized list of topics, instrument pages, principles, and homework. The list follows the approximate order of presentation. However, since discussion is a vital element in the IE class, the actual information and topics discussed varied between classes and class periods. All worksheets pages were drawn from the first year IE instruments. The principles, instrument pages, and homework that were found to be most useful have been marked with an asterisk (*).

A. Introduction to IE program.
* Page: Organization of Dots, cover page
* Principle: It is necessary to organize for efficiency, convenience, and understanding. All kinds of things can be organized.
* Principle: Man imposes order on the universe. Object and events are separate until man organizes them according to relationships that he determines.
* Homework: The students were asked to outline a chapter that was assigned in another class. They were to organize the main ideas and points in the chapter.

B. Introduced planning elements from teacher's manual
* Page: Organization of Dots, page 1
* Principle: When we are precise and specific in definitions and other things, it means exactly the same thing to every one (meaning is universal). Precise definitions indicate exactly what we are talking about.

Homework: The students were asked to use the planning elements and develop a study plan in outline form.

C. Discussed homework, the need for planning, and the relevance of the class.
Page: Finished page 1, organization of dots.

* Principle: We often need to plan before beginning a task.

* Principle: It is often necessary to conform, but we must evaluate and think in order to understand.

Homework: none

D. Presented the problem solving model drawn from the teacher's manual.


Principle: We can make a decision on what to do, and the order in which we do it for a variety of reasons.

* Principle: We should always follow certain guidelines in problem solving.

* Homework: The students were asked to apply the problem solving model to some problem, question, or puzzle concerning them.

E. * Page: Organization of dots, page 2

* Principle: Sometimes we have tasks which have no cues to help us solve them, so we have to develop our own strategy.

Homework: Students were asked to complete page 2, write out their difficulties with the page, and write out the strategies they used to complete it.

F. * Page: Orientation in Space, cover page

* Principle: There are many alternative paths to reach a goal.

* Principle: Deciding on a path requires defining the goal, one's current position, and available routes.

Principle: There is a necessity for eliminating trial-and-error behavior by deciding on a path and making a plan.

* General principle: It is necessary to think carefully and review all alternative before reaching a decision.

Homework: The students were asked to make a chart, in which they used themselves as reference points. They were to chart their present location (college), what led them there, and where they were going.
G. Page: Orientation in Space, page 9

* Principle: We all are different for a variety of reasons, and in order to truly understand another's viewpoint, it is often necessary to put yourself in the position of the other.

Homework: The students were give page 10 of Orientation in Space and asked to write out a description of the page, and then describe what is happening on the page.

H. * Page: Orientation in Space, page 10

* Principle: In order to understand another person's behavior, we must know where they are coming from.

Homework: None

I. * Page: Comparison, cover page

* Principle: Comparison is at the basis for all of our decisions and judgments.

* Homework: The students were asked to compare psychology 050 class with any other class along ten characteristics determining in what they were the same and different.

J. Page: Comparison, page 2

Principle: When you make comparisons, it is necessary to consider inclusive and exclusive concepts

Homework: The students were asked to complete pages 9 and 10 of Comparisons.

K. Pages: Comparisons, page 9 and 10

* Principle: In order to compare, we must distinguish both similarities and differences.

* Principle: Sometimes when comparing, we must first establish our parameters of comparison before we start the process.

Homework: None

L. * Pages: Analytic Perception, cover page and page 3.

* Principle: When we do not understand something, we often attempt to interpret the environment or analyze so we can derive meaning.
* Principle: In order to communicate effectively and for true understanding, we must ask for clarification if necessary.

* Homework: The students were instructed to ask a teacher for clarification on something in class, homework, or a test question. They were then to write a short, specific description of what the questions was and how they endeavored to have it answered.

M.
Summary class: Reviewed homework and Analytic Perception instrument; briefly reviewed the different instruments covered in class and topics in each; emphasized to students that they practice and apply the principles and skills developed in the class.
Appendix F

Lorge-Thorndike ANCOVA: \( \bar{X} \) and SD

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Note. The posttest scores have been corrected 4.4 points for practice effect.
Appendix G
Appendix G

TSCS ANCOVA: $\bar{X}$ and SD

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\( \chi^2 = 1.90, \, df = 3, \, \text{n.s.} \)

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\( \chi^2 = .76, \, df = 3, \, \text{n.s.} \)
Appendix H2

Study Habits Pretest Item 3: Chi-Square Summary

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($\chi^2 = 1.33, \ df = 2, \ n.s.$)

Study Habits Posttest Item 1: Chi-Square Summary

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($\chi^2 = .54, \ df = 2, \ n.s.$)
### Study Habits Posttest Item 2: Chi-Square Summary

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### Study Habits Posttest Item 3: Chi-Square Summary

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($\chi^2 = 2.33, df = 2, n.s.$)
Appendix H4

Study Habits Pretest Items 5 & 6, Posttest Item 5: \( \bar{X} \) and SD

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Appendix H5

Study Habits Pretest Item 7, Posttest Item 6: Summary of ANOVA

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<td>Between</td>
<td>41</td>
<td>125.82</td>
<td></td>
<td></td>
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<tr>
<td>Groups</td>
<td>1</td>
<td>.96</td>
<td>.96</td>
<td>.31</td>
<td>n.s.</td>
</tr>
<tr>
<td>Error</td>
<td>40</td>
<td>124.86</td>
<td>3.12</td>
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<td>Within</td>
<td>42</td>
<td>108.50</td>
<td></td>
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<td>Levels</td>
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<td>3.44</td>
<td>3.44</td>
<td>1.31</td>
<td>n.s.</td>
</tr>
<tr>
<td>Groups by Levels</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>1</td>
<td>.02</td>
<td>.02</td>
<td>.01</td>
<td>n.s.</td>
</tr>
<tr>
<td>Error</td>
<td>40</td>
<td>105.04</td>
<td>2.63</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>234.32</td>
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</tbody>
</table>
Appendix H6

Study Habits Pretest Item 7, Posttest Item 6: $\bar{X}$ and SD

<table>
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<tr>
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<th>Control $(n=21)$</th>
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</thead>
<tbody>
<tr>
<td>Pretest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\bar{X}$</td>
<td>4.86</td>
<td>5.09</td>
</tr>
<tr>
<td>SD</td>
<td>1.90</td>
<td>1.04</td>
</tr>
<tr>
<td>Posttest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\bar{X}$</td>
<td>5.29</td>
<td>5.48</td>
</tr>
<tr>
<td>SD</td>
<td>1.65</td>
<td>2.02</td>
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Appendix H7

Response 8 of Study Habits Pretest and Posttest Item 4

<table>
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<th>Category</th>
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</tr>
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<tbody>
<tr>
<td></td>
<td>Pre (n=29)</td>
<td>Post (n=21)</td>
</tr>
<tr>
<td>learn</td>
<td>41%</td>
<td>57%</td>
</tr>
<tr>
<td>specific content</td>
<td>34%</td>
<td>48%</td>
</tr>
<tr>
<td>comprehension</td>
<td>7%</td>
<td>24%</td>
</tr>
<tr>
<td>read</td>
<td>17%</td>
<td>19%</td>
</tr>
<tr>
<td>review</td>
<td>10%</td>
<td>19%</td>
</tr>
<tr>
<td>procedure</td>
<td>7%</td>
<td>19%</td>
</tr>
<tr>
<td>general knowledge</td>
<td>14%</td>
<td>10%</td>
</tr>
<tr>
<td>analyze</td>
<td>0</td>
<td>10%</td>
</tr>
<tr>
<td>memorize</td>
<td>7%</td>
<td>5%</td>
</tr>
<tr>
<td>time</td>
<td>10%</td>
<td>0</td>
</tr>
<tr>
<td>remember</td>
<td>3%</td>
<td>0</td>
</tr>
<tr>
<td>thinking</td>
<td>3%</td>
<td>0</td>
</tr>
<tr>
<td>concentrate</td>
<td>3%</td>
<td>0</td>
</tr>
<tr>
<td>purposeful (e.g. grades)</td>
<td>7%</td>
<td>0</td>
</tr>
<tr>
<td>assignment</td>
<td>7%</td>
<td>0</td>
</tr>
<tr>
<td>work/effort</td>
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<td>0</td>
</tr>
<tr>
<td>meditation</td>
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<td>0</td>
</tr>
<tr>
<td>observation</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>outline/write/notes</td>
<td>3%</td>
<td>0</td>
</tr>
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</table>
Appendix H7 (continued)

<table>
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<tr>
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<th></th>
<th>Control</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre (n=29)</td>
<td>Post (n=21)</td>
<td>Pre (n=36)</td>
<td>Post (n=30)</td>
</tr>
<tr>
<td>Increase IQ</td>
<td>0</td>
<td>0</td>
<td>3%</td>
<td>0</td>
</tr>
<tr>
<td>class preparation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7%</td>
</tr>
<tr>
<td>self-discipline</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7%</td>
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<tr>
<td>listen</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3%</td>
</tr>
</tbody>
</table>

Note. Each category is either a term that a student used or a concept implied in their response.
## Appendix H8

**Response of Study Habits Pretest Item 8, Posttest Item 7**

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<tr>
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<th>Control</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre (n=29)</td>
<td>Post (n=21)</td>
<td></td>
<td>Pre (n=36)</td>
<td>Post (n=30)</td>
<td></td>
</tr>
<tr>
<td>read (book, notes etc.)</td>
<td>59%</td>
<td>57%</td>
<td></td>
<td>44%</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td>review</td>
<td>17%</td>
<td>43%</td>
<td></td>
<td>25%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>highlight/notes/outline</td>
<td>28%</td>
<td>29%</td>
<td></td>
<td>28%</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>quizzing</td>
<td>7%</td>
<td>19%</td>
<td></td>
<td>11%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>time</td>
<td>10%</td>
<td>19%</td>
<td></td>
<td>8%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>isolation</td>
<td>7%</td>
<td>20%</td>
<td></td>
<td>17%</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>repetition</td>
<td>21%</td>
<td>14%</td>
<td></td>
<td>17%</td>
<td>17%</td>
<td></td>
</tr>
<tr>
<td>quiet</td>
<td>3%</td>
<td>10%</td>
<td></td>
<td>17%</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>music/TV</td>
<td>7%</td>
<td>10%</td>
<td></td>
<td>11%</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>memorize</td>
<td>24%</td>
<td>10%</td>
<td></td>
<td>11%</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>work with others</td>
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<td>5%</td>
<td></td>
<td>3%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>comprehend</td>
<td>7%</td>
<td>5%</td>
<td></td>
<td>8%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>SQ3R</td>
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<td></td>
<td>0</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>knowledge</td>
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<td>0</td>
<td></td>
<td>3%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>learn</td>
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<td>0</td>
<td></td>
<td>3%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>remember</td>
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<td></td>
<td>8%</td>
<td>0</td>
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</tr>
<tr>
<td>think</td>
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<td></td>
<td>3%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>imaging</td>
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<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>gather materials</td>
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## Appendix H8 (continued)

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<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre (n=29)</td>
<td>Pre (n=36)</td>
</tr>
<tr>
<td></td>
<td>Post (n=21)</td>
<td>Post (n=30)</td>
</tr>
<tr>
<td>assignments/homework</td>
<td>3% 0</td>
<td>3% 7%</td>
</tr>
<tr>
<td>adjust surroundings</td>
<td>0 0</td>
<td>11% 10%</td>
</tr>
<tr>
<td>concentrate</td>
<td>0 0</td>
<td>11% 3%</td>
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</table>

Note. Each category is either a term that a student used or a concept implied in their response.
Appendix H9

Response & of Study Habits Posttest Item 8

<table>
<thead>
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<th>Category</th>
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<th>Control (n=30)</th>
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<tr>
<td>no change in attitude</td>
<td>19%</td>
<td>13%</td>
</tr>
<tr>
<td>positive/like</td>
<td>24%</td>
<td>17%</td>
</tr>
<tr>
<td>negative/do not like</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>have to/necessary</td>
<td>19%</td>
<td>37%</td>
</tr>
<tr>
<td>more serious</td>
<td>0%</td>
<td>7%</td>
</tr>
<tr>
<td>study more</td>
<td>0%</td>
<td>23%</td>
</tr>
<tr>
<td>more important</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>more difficult</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>has purpose</td>
<td>14%</td>
<td>3%</td>
</tr>
<tr>
<td>enjoy learning more</td>
<td>5%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note. Each category is either a term that a student used or a concept implied in their response.
Appendix II

Course Evaluation Item 2: $\bar{X}$ and SD of Rankings

<table>
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<tr>
<th>Statistic</th>
<th>Experimental ($n=29$)</th>
<th>Control ($n=20$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{X}$</td>
<td>1.93</td>
<td>2.15</td>
</tr>
<tr>
<td>SD</td>
<td>.92</td>
<td>.81</td>
</tr>
</tbody>
</table>

Course Evaluation Item 3: $\bar{X}$ and SD of Rankings

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Experimental ($n=29$)</th>
<th>Control ($n=20$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{X}$</td>
<td>3.66</td>
<td>4.20</td>
</tr>
<tr>
<td>SD</td>
<td>.94</td>
<td>1.06</td>
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</table>
Appendix I2

Course Evaluation Item 4: $\bar{X}$ and SD of Rankings

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<th>Control $(n=20)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{X}$</td>
<td>4.28</td>
<td>4.45</td>
</tr>
<tr>
<td>SD</td>
<td>.75</td>
<td>.83</td>
</tr>
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</table>

Course Evaluation Item 7: Chi-Square Summary

<table>
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<th>Group</th>
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</thead>
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<tr>
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<td>Yes</td>
<td>No</td>
<td>No Response</td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>27</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

($\chi^2 =1.45, \ df = 2, \ n.s.$)
### Course Evaluation Item 8: Chi-Square Summary

<table>
<thead>
<tr>
<th>Group</th>
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<th>No</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>27</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>16</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

($X^2 = 2.43, \, df = 2, \, n.s.$)

### Course Evaluation, Item 9: Chi-Square Summary

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<tr>
<th>Group</th>
<th>Yes</th>
<th>No</th>
</tr>
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<tbody>
<tr>
<td>Experimental</td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>Control</td>
<td>19</td>
<td>1</td>
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</tbody>
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($X^2 = .22, \, df = 1, \, n.s.$)
Appendix I4

Course Evaluation Item 12: \( \bar{x} \) and SD of Rankings

<table>
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<tr>
<th>Statistic</th>
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<th>Control (n=19)</th>
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</thead>
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<tr>
<td>( \bar{x} )</td>
<td>2.39</td>
<td>2.32</td>
</tr>
<tr>
<td>SD</td>
<td>1.23</td>
<td>.82</td>
</tr>
</tbody>
</table>

Course Evaluation Item 13: \( \bar{x} \) and Mdn of Rankings

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<th>Control (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \bar{x} )</td>
<td>1.09</td>
<td>1.31</td>
</tr>
<tr>
<td>Mdn</td>
<td>1.05</td>
<td>1.18</td>
</tr>
<tr>
<td>Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \bar{x} )</td>
<td>2.36</td>
<td>2.05</td>
</tr>
<tr>
<td>Mdn</td>
<td>2.40</td>
<td>1.85</td>
</tr>
<tr>
<td>Homework</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \bar{x} )</td>
<td>2.55</td>
<td>2.63</td>
</tr>
<tr>
<td>Mdn</td>
<td>2.55</td>
<td>2.63</td>
</tr>
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</table>
Appendix 15

Course Evaluation Item 14: Chi-Square Summary

<table>
<thead>
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<th>Do not know</th>
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<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Control</td>
<td>16</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
\[\chi^2 = 4.28, \text{ df} = 2, \text{ n.s.}\]

Course Evaluation Item 15: Chi-Square Summary

<table>
<thead>
<tr>
<th>Group</th>
<th>Yes</th>
<th>No</th>
<th>Maybe</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>21</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Control</td>
<td>13</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
\[\chi^2 = 1.29, \text{ df} = 3, \text{ n.s.}\]
Appendix 16

Response % of Experimental Group: Course Evaluation Item 16

<table>
<thead>
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<th>Category</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>change</td>
<td>76%</td>
</tr>
<tr>
<td>no change</td>
<td>24%</td>
</tr>
<tr>
<td>more discussion</td>
<td>14%</td>
</tr>
<tr>
<td>set goals and purpose of class clearly</td>
<td>3%</td>
</tr>
<tr>
<td>change to full semester course</td>
<td>14%</td>
</tr>
<tr>
<td>add homework and worksheets</td>
<td>3%</td>
</tr>
<tr>
<td>less homework</td>
<td>3%</td>
</tr>
<tr>
<td>change/discard worksheets</td>
<td>14%</td>
</tr>
<tr>
<td>better homework assignments</td>
<td>3%</td>
</tr>
</tbody>
</table>

(n=29)

Note. Each category is either a term that a student used or a concept implied in their response.
Appendix 17

Response & of Experimental Group: Course Evaluation Item 18

<table>
<thead>
<tr>
<th>Category</th>
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</thead>
<tbody>
<tr>
<td>think before acting</td>
<td>21%</td>
</tr>
<tr>
<td>different way of approaching tasks</td>
<td>17%</td>
</tr>
<tr>
<td>different outlook</td>
<td>10%</td>
</tr>
<tr>
<td>think more rationally/constructively</td>
<td>7%</td>
</tr>
<tr>
<td>different perspective</td>
<td>7%</td>
</tr>
<tr>
<td>different strategies</td>
<td>7%</td>
</tr>
<tr>
<td>different alternatives</td>
<td>7%</td>
</tr>
<tr>
<td>more open-minded</td>
<td>7%</td>
</tr>
<tr>
<td>think more</td>
<td>7%</td>
</tr>
<tr>
<td>&quot;look&quot; at things more carefully</td>
<td>7%</td>
</tr>
<tr>
<td>gathering all the facts</td>
<td>7%</td>
</tr>
<tr>
<td>more specific</td>
<td>3%</td>
</tr>
<tr>
<td>how to ask questions</td>
<td>3%</td>
</tr>
<tr>
<td>problem-solving steps</td>
<td>3%</td>
</tr>
<tr>
<td>definitions</td>
<td>3%</td>
</tr>
<tr>
<td>talking it out</td>
<td>3%</td>
</tr>
<tr>
<td>come up with other ideas</td>
<td>3%</td>
</tr>
<tr>
<td>more organized</td>
<td>3%</td>
</tr>
</tbody>
</table>

Note. Each category is either a term that a student used or a concept implied in their response.