

A STUDY OF SELECTED INTEREST FACTORS
AS RELATED TO OUTCOMES OF THE
PROGRAM OF GENERAL EDUCATION AT
MICHIGAN STATE COLLEGE

Thesis for the Degree of Ph. D
MICHIGAN STATE COLLEGE

Victor Horowitz
1954

This is to certify that the

thesis entitled

A STUDY OF THE RELATIONSHIP OF SELECTED INTEREST
FACTORS TO OUTCOMES OF THE PROGRAM OF GENERAL
EDUCATION AT MICHIGAN STATE COLLEGE.

presented by

Mr. Victor Horowitz

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of the requirements for

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Major professor

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A STUDY OF SELECTED INTEREST FACTORS AS RELATED TO
OUTCOMES OF THE PROGRAM OF GENERAL EDUCATION
AT MICHIGAN STATE COLLEGE

By
Victor Horowitz

AN ABSTRACT

Submitted to the School of Graduate Studies of Michigan
State College of Agriculture and Applied Science
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Guidance and Counselor Training

Year 1954

Approved

Walter F. Johnson

THESE

The objectives of the study were as follows: By means of the Test of Critical Thinking, the Test of Critical Analysis in Reading and Writing, and the Inventory of Beliefs, as developed by the committees of the Cooperative Study of Evaluation in General Education of the American Council on Education,

A. To attempt to determine whether, over a period of one academic year and within the areas of Critical Thinking, Ability to do Critical Analysis in Reading and Writing, and Level of Maturity of Beliefs and Reactions, change or gain can be discovered in Freshman Students.

B. To attempt to determine whether, within the areas of Critical Thinking, Ability to do Critical Analysis in Reading and Writing, and Level of Maturity of Beliefs and Reactions, differences can be distinguished between the change or gain of Freshman students in the various interest categories, or major areas of study.

The tests were first administered to 1942 Freshman students who entered Michigan State College in September, 1951. The tests were administered again during the last week of the Spring Term, 1952, to a re-test group of 569 students. The intervening period of change was three complete terms.

The "t" - test of significance between the means of pre- and post-tests was used to determine whether significant differences in change or gain over a period of one academic year could be discovered in each of the areas studied. The analysis of variance by covariance adjustment technique was used to determine whether significant differences could be distinguished between the change or gain of students in the various interest groups, within each of the areas studied. A comparison or ranking of the adjusted post-test means was also made.

The results of the study were as follows:

A. Considering the whole, or total-group population (N=569), a significant change or gain over a period of one academic year was discovered in each of the three areas measured. (The differences between pre- and post-test means were significant at the 1% level of confidence.)

B. Considering the total population as divided into the various preference-group or interest categories, (i.e., declared or intended majors), and with (a) pre-test scores or initial scores and (b) scholastic aptitude as measured by the A.C.E. Psychological Examination as variables:

1) In the area of Critical Thinking, no significant differences were detected at the 5% level of confidence between the change or gains of students in the various categories.

2) In the area of Ability to do Critical Analysis in Reading and Writing, significant differences at the 1% level of confidence were discovered between the change or gains of students in the various categories.

3) In the area of Level of Maturity of Beliefs and Reactions, significant differences at the 1% level of confidence were discovered between the change or gains of students in the various categories.

COMPARISON OF ADJUSTED POST-TEST MEANS AFTER PRE-POST

TEST PERIOD OF ONE ACADEMIC YEAR

Group Code	Preference or Interest Groups	C.A.R. and W. (N=569)		I. of B. (N=569)	
		Rank*	Adjusted Post-Test Means	Rank*	Adjusted Post-Test Means
11	Biological and Physical Science	6	17.9154	1	71.768
0	Pre-Medical, -Dental, -Vet, Nursing Ed.	4	19.1837	11	60.173
1	Agriculture and Forestry	2	19.4007	6	63.743
2	Business and Hotel Administration	7	17.6839	8	61.488
3	Engineering	11	14.8376	9	61.068
4	Home Economics	1	21.7939	2	66.932
5	Fine Arts	3	19.3954	4	65.211
6	Elementary Education	8	17.8368	10	60.650
7	Language and Literature	9	17.5663	7	62.502
8	Social Science and Social Service	10	15.4297	3	66.827
9	No-Preference	5	18.8600	5	64.532

Post-Test Means have been adjusted for initial performance (Pre-Test), and for scholastic aptitude as measured by the A.C.E. Psychological Examination.

*Rank refers to standing of adjusted Post-Test Mean Score when compared with Post-Test Mean Scores of other Groups.

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Department of Guidance and Counselor Training

Year 1954

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The writer deeply appreciates the data and other assistance so generously made available by the Co-operative Study of Evaluation in General Education of the American Council on Education.

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V. H.

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Candidate for the Degree of
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Final examination, January 26, 1954, 9:30 a. m., Conference Room,
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To Dorothy

To Dorothy
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INTERESTS, CRITICAL THINKING AND EVALUATION

* * *

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CHAPTER I

Introduction to the Problem

The topic, 'General Education', and the development of programs of general education, have become in the past ten years both matters of consuming interest and of marked disagreement. Some of this disagreement is semantic in nature, some of it is due to fundamental differences in philosophy, and much of it is caused by different and frequently unverified hypotheses. The discussions and the programs have generally taken into consideration almost every factor except the most important one - determination of the changes in students brought about through experience in a program. Unless and until something concrete is done in determining the significance of a given approach through collecting evidence on the student growth induced, there is little real basis for espousing one viewpoint or program over another. (55:1)

It is with this "most important" factor that this study is concerned; that is, with the determination of the changes in students brought about through experience in a program of general education.

Background of the Study

This investigation, one of two parallel studies jointly planned and executed by the writer and Carroll M. Pike, Jr., respectively, is designed and planned as a study supplementary to that being carried on by the Cooperative Study of Evaluation in General Education of the American Council on Education.

This latter evaluation study, hereafter referred to as The Cooperative Study, was organized in 1949 under the sponsorship of the American Council of Education and, under the direction of Dr. Paul L. Dressel, developed the test instruments used in this investigation.

Since one of the themes pervading this entire dissertation is its relationship to the larger or "parent" study, it would probably be advantageous to make some brief mention at this point of the organization, purposes and activities of the Cooperative Study.

A final report, to be issued later in book form, will include a comprehensive summary of the purposes and mode of development and operation of the study, technical reports on the evaluation procedure, and on the accumulated data of the Cooperative Study.

However, in order to develop more adequately at this time the background of this research, it may be advisable and pertinent to elaborate just a little on the major purposes of the parent study as given in the article by Dressel and Mayhew (57). These major purposes were:

1. A focusing of attention on the need for research and evaluative activities in general education and, associated with this, an arousal of interest on the part of general education staff in initiating such activity.
2. The development of improved evaluation procedures and the collection of actual evidence on changes made by students in regard to general education objectives.
3. One or more publications which, by presenting new developments in evaluation and some evidence on the outcomes of general education, might point the way to even more definitive research and challenge others to undertake it.

It will be evident, then, that this dissertation is planned as a step along the paths pointed out in items 2 and 3 above. In addition, as the test instruments used in this research were those developed and used by the Cooperative Study, this local application of these nationally

developed instruments may be considered as a further validation study of these instruments for this particular purpose. A still further tie with the parent study lies in the fact that the population used was one of the several groups, or samples, selected by the Cooperative Study for its own research purposes, and therefore some of the initial, or pre-test data are the same for both studies.

Statement of the Problem

The general purpose of this study is the evaluation of certain aspects of the General Education program at Michigan State College with relation to students' interest areas.

More specifically, the objectives of the study are as follows:
By means of the Test of Critical Thinking, the Test of Critical Analysis in Reading and Writing, and the Inventory of Beliefs, as developed by the Committees of the Cooperative Study,

- A. To attempt to determine whether, over a period of one academic year, and within the areas of Critical Thinking, Ability to do Critical Analysis in Reading and Writing, and Level of Maturity of Beliefs and Reactions, change or gain can be discovered in Freshman Students.
- B. To attempt to determine whether, within the areas of Critical Thinking, Ability to do Critical Analysis in Reading and Writing, and Level of Maturity of Beliefs and Reactions, differences can be distinguished between the change or gain of Freshman Students in the various interest categories, or major areas of study.

Definition of Terms

The Pike Study - refers to the inquiry being carried out by Carroll M. Pike, an advanced graduate student in the Department of Guidance and

Counselor Training at Michigan State College. Simultaneous to the planning of this study, Mr. Pike was planning a research design closely related to the overall objectives of this investigation. Recognizing the many advantages to be gained from coordinated planning and execution, steps were taken to integrate closely the two studies, thus making possible the elimination of needless duplication in the collection of test data and information, and facilitating the cross-checking of the statistical work. The Pike Study utilized the same test instruments and the same population as does this study.

Special-Permission Students - refers to those students who, because of proven superior proficiency or ability in one or more of the Basic College subject-matter areas ¹ (in this case, the area of Communication Skills), are permitted to take the final third-term Comprehensive Examinations ² at the end of only one or two terms of academic work in those areas. Thus they were not readily available for re-testing at the end of the Spring Quarter along with the other members of the original population.

¹ The Basic College was established as a separate administrative unit in 1944, in order to provide all Michigan State College students with a broad program of basic education, or "general education", as it is often called. The major purpose of this program is to help students to live more intelligently in a free society. The curriculum consists of four comprehensive courses: Communications Skills and Natural Science, usually taken during the Freshman Year; and Social Science and Humanities, usually taken during the Sophomore Year.

² Final third-term Comprehensive Examination - Final term grades in the basic courses are partially (50%) determined by a two-hour comprehensive examination given at the end of each term of a basic course. (The remaining 50% is based upon the instructor's evaluation.) The examinations are cumulative and increasingly comprehensive from one term to the next, that is, examinations for the second and third terms include materials from the preceding terms as well as material of the current term.

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A.C.E. Psychological Examination Scores - The "Q" score, designed as an indication of the ability involving quantitative reasoning, is intended to indicate ability involved in scientific and technical curricula.

The "L" score, designed as an indication of linguistic ability, can be considered significant for curricula involving the study of language, literature, social studies, etc. The total or "T" score, a combination of these two scores, can therefore be considered as an indication of general academic aptitude.

Critical Thinking - It is recognized that ability in critical thinking is not a single ability, but is a complex of only partially-related variables. In the development of the Test of Critical Thinking the following variables were considered to be a cross-section of those major components of critical thinking for which objective tests could be devised. (525:1)

1. Ability to define problems (to recognize evasions and to select the most inclusive statements of relative factors.)
2. Ability to select pertinent information for the solution of problems.
3. Ability to recognize unstated assumptions.
4. Ability to select relevant and promising hypotheses.
5. Ability to recognize the structure of an argument, to make valid inferences, and to distinguish valid from invalid inferences.

Therefore, the interpretation of critical thinking as used in this research refers to these listed and defined abilities.

Critical Thinking Test - Form A - The Critical Thinking Test - Form A, an instrument consisting of 57 items stated as objective-type test questions, is designed to measure the ability of college freshmen and sophomores to demonstrate the above-mentioned abilities. (See copy in Appendix.)

Inventory of Beliefs - an instrument consisting of 120 statements with which students are expected either to agree or to disagree, provides opinionnaire evidence on the statements themselves, and also yields, as a total score, an index of certain aspects of personality structure.

"The fundamental assumption underlying the Inventory of Beliefs is that the objectives of general education can serve as a base from which may be inferred the model organization characterizing the personalities of those most adaptable to the purposes of general education." (527:4) (See copy in Appendix.)

Test of Critical Analysis in Reading and Writing - The first part of this test presents students with three passages dealing with the subject of the good life. These passages, drawn from Thoreau's Walden, from the Rubaiyat, and from the "Sermon on the Mount", are followed by questions requiring the student to make comparisons between the three points of view expressed in the three passages.

In the second part of the test the students are presented with an exact reproduction of a student theme comparing the three points of view, and are then asked questions concerning the general writing ability demonstrated in the theme.

This test has been preceded by some original work done by Paul Diederich of the Educational Testing Service in connection with the U.S. Armed Forces Institute in the early 1940's. (See copy in Appendix.)

Limitations of the Study

One of the limitations of this research lies in the fact that it was designed and executed as a study supplementary to that of the Cooperative Study. The instruments used and the population being tested and studied had both been selected in advance, and the initial or pre-test information had already been collected by the time this study was planned. Had time and facilities been unrestricted, it might have been possible and better to refine further the instruments and more exactly select the sample - yet, if this supplementary study were to be of material value to the whole Cooperative Study, it was imperative that its results be available at somewhat the same time as the others. Nevertheless, the instruments were carefully examined and available preliminary data were carefully studied before the final decision was made to use them. This particular aspect is more completely discussed in Chapter III.

Similarly, the population or sample was carefully studied and analysed for its representativeness of the whole freshman body tested. As will be shown in Chapter II, while statistical tests later proved the representativeness of both the initial as well as the final working population, theoretically, it would probably have been more desirable to control the selection of the sample more carefully. This was, however, administratively impossible for the purposes of the Cooperative Study and in view of the fact that this study made use of initial data gathered by the parent testing group, the limitation must be accepted as applicable to this study as well.

A second possible limitation of this study lies in the fact that later evidence collected by the Cooperative Study cast considerable doubt on the reliability and validity of Form B of the Critical Thinking Test. This was, in part, a result of the fact that portions of this form were developed from material remaining after the best items had been used in constructing Form A. Nevertheless, for the purposes of this study, the effective working sample for this particular test was reduced by almost half, as a result. Again, even though later statistical evidence showed that there was no significant difference between the groups that were given Forms A and B and the entire tested population, this factor must be considered as another possible limitation of the study.

A third factor which must be considered as a possible limitation of this study has its basis in the manner in which the test instruments were administered to the population. Originally in the Fall pre-testing program the three test instruments were administered along with other tests of the Cooperative Study, during the Orientation Week of 1951³ and during the same general period as that in which the entrance examination battery was given to the students.

It must therefore be assumed that the high motivation factor usually associated with this first contact of freshmen with the College entered into the performance registered on these instruments. However,

³ Orientation Week - The first week of the Fall Term is known as Orientation Week. This is the period during which students meet with their enrollment officers or advisors, and register for the courses they will attend during the term. Freshman students and new transfer students are also required to take special Orientation Examinations. These may include such tests as the A.C.E. Psychological Examination, the Cooperative Reading Test, Hearing, Speech and Swimming Tests, as well as examinations related to the various basic courses.

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in the Spring post-testing program, only one of the instruments, the Test of Critical Analysis in Reading and Writing, was administered in a parallel situation. This test was given as part of the year-end Comprehensive Examination in the Communication Skills course, and one might assume that a high degree of motivation existed in this situation as well.

However, the re-tests of the other two instruments, namely, the Test of Critical Thinking - Forms A and B, and the Inventory of Beliefs, were administered in released time made available by the Department of Written and Spoken English, or Department of Communication Skills, as it is now known. One of the conditions imposed by the department on this phase of the re-testing program was that the students must be informed that this was an experimental testing program only - and that it would have no effect or bearing on their final standing or grades. One might well question, then, whether this did not create a mood that was entirely different from that existing in the other testing situations, especially insofar as the motivational aspects were concerned.

A fourth factor which must be introduced in any consideration of possible limitations of this study arises out of the fact that it was not possible to reach or re-test the 118 students who fall into the Drop-out⁴ category, or the 182 students in the Special-Permission and Absent⁵ categories. Since the Test of Critical Analysis in Reading and Writing was to be administered as part of the year-end examinations, it was de-

⁴ The Drop-out Category - refers to those students who, for one reason or another, either leave school before the end of the academic year, or fail to return after the Fall or Winter quarters.

⁵ The Absent Category - refers to those students who, because of illness or other factors, were absent from their classes during the week in which the post-test examinations were administered.

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cided that the other tests should also be given as late in the academic year as possible so that the elapsed "time of growth" would be nearly identical for all three instruments. This was done. However, one concomittant factor which then arose was the lack of time remaining to seek out and re-test all who were missed in the regular course of events of this testing procedure.

An attempt was made, during final examination week, to rectify this factor, but lack of interest and cooperation on the part of the students who were already burdened by examinations forced the abandonment of this plan.

Another factor which may or may not be considered as a limitation of this study, but which is certainly worth further mention, concerns the length of time, or "period of change" allowed to elapse between test and re-test administration. Again, because this study was intended in part as a supplement to the Cooperative Study, the test - re-test period was made the same as for that project, namely, one academic year. It is possible that a re-test administration at the end of each academic quarter would have been preferable, especially since students who were to drop out during the year and so become unavailable for the final year-end testing, would have been tested at least once and possibly twice before this time. On the other hand, it is by no means certain that an elapsed-time of one academic quarter between testings would have been sufficient for significant change or gain to have taken place. Quite possibly, too, some of the "originalness" of an instrument such as the Test of Critical Thinking would have been lost by too frequent administration.

Plan of the Study

In the following chapter an attempt is made to explain the design of this study, the statistical evaluation procedure used and some of the reasoning behind the plan adopted. A discussion of the representativeness of the sample and some of the statistical data involved in its determination are also included, along with a description of the data sheet used to gather and combine the raw data. Some mention is also made of the manner in which the collected data were coded and adapted for use with I.B.M. cards.

Chapter III includes a review of the typical procedure involved in the development of the instruments used in this study. Specific reference is made to the Test of Critical Thinking, Form A, as representative of the method used on all three instruments. In addition, such pertinent statistics and data concerning the reliability, validity and item analysis of the three test instruments as have been made available by the Co-operative Study in the Instructor's Manuals for these instruments, are summarized and set forth in order to present, within a single unit, as complete as possible a picture of the total research situation and of the instruments used.

Chapter IV includes a presentation of the data collected, the statistical treatment of the data, and the results obtained by the use of the Test of Critical Thinking, Form A, the Test of Critical Analysis in Reading and Writing, and the Inventory of Beliefs respectively.

Chapter V is devoted in part to a discussion of the relationships between the results obtained for the individual instruments in the preceding chapter when seen as complementary parts of the "whole" study rather

than as separate units in themselves. A summation of all obtained results and presentation of some conclusions which seem to be warranted at this time is also included in this chapter, along with a discussion of some implications for further study which arise from a review of the procedures used and the results obtained in this study. Some generalizations for general education which seem to be appropriate are also given in the form of hypotheses requiring further consideration and study.

No attempt is made to include a comprehensive review of the literature which exists either in the area of general education or in the area of evaluation in general education because these subjects are being dealt with rather extensively by the Cooperative Study of Evaluation in General Education in its several published articles and in the major publication to be brought forth in the near future. However, a rather extensive bibliography of material pertinent to the topics of General Education, Student Interests, and Critical Thinking is presented at the end of Chapter V.

No attempt has been made to make this a completely exhaustive bibliography; instead, the references have been prepared in connection with the preparatory work done as background for the development of this research plan, and therefore pertain rather closely to this problem area.

CHAPTER II

Statistical Design of the Study

The purpose of this research has been defined as an attempt to study the factor of change, and more specifically, the change in students when considered in the light of their own major interest areas. This matter of change may be considered one of the bases of the entire educational process - for the purpose of education is to guide students from wherever they may happen to be toward some specific objective or goal. However, while there is usually little question about this basic assumption, questions are frequently raised concerning the actual process of change, such as, "How successful is this or that technique?" or "What effect does extra-curricular experience have on the rate of learning?"

There have been many attempts to answer these and other related questions, utilizing many different approaches. One such approach, making use of objective tests administered before and after a particular educational experience, has been used in this study. Here the particular educational experience being evaluated is the effect of one academic year of college work, with particular attention to the students' major areas of interest or "stated area of intended specialization".

What would at first glance appear to be a rather straightforward research question requires the development of research designs and statistical techniques which are not quite so straightforward. A rather perplexing problem for which no simple or clearcut answer is available arises when the question of change or gains, involving the use of pre- and post-tests,

is considered. At best, there are two possible approaches to this problem: (a) the so-called "Classical" or traditional method in which the differences in gain for the various groups are tested against each other by the use of their standard error of differences, and (b) the "Covariance Adjustment Technique", which is outlined below.

In both instances the intention is to discover and account for, as much as possible, whatever initial differences exist so that the final differences will reflect change resulting from the educational experience rather than from differences in original status. The "Classical" method would consider net change as the final difference between the groups, corrected for their initial difference. The assumption underlying this concept is, however, subject to considerable question for it presumes that each unit of difference in final status is produced by a corresponding unit of difference in initial status, or as McNemar states, "This type of adjustment implies a one-to-one relationship between initial and final scores." (535:342) He then goes on to state that, "Since a perfect correlation is never found or even approached in practice, one may question whether the usual procedure of comparing changes is really defensible." (535:342)

There is no question about the need for correcting the differences obtained on the final post-test for differences in initial status. The primary difference, insofar as this aspect is concerned, lies with the manner in which the adjustment is made. The "Covariance Adjustment Technique", as it is described in McNemar, Chapter 15 (535:318-330), provides "...a method, based on predictions by means of regression equations, of correcting the final means for differences in initial status, with

proper allowance made for the degree of correlation between initial and final score." (535:342)

Another important factor which must be taken into account when considering these two possible approaches is that they do not necessarily yield similar results. As Mcnemar points out,

....now the ordinary and the covariance methods of testing the significance of gains differ not only in the correction or adjustment to final means, but also in the resultant sampling error. The ordinary technique uses a standard error which definitely includes, either explicitly or implicitly, the variance for both initial and final scores and the correlation of initial with final, whereas the error term used in the covariance method is a direct function of the degree of correlation and of the variance of the final scores only. In other words, the net differences being tested are not the same, and neither are the error terms the same. In general the two methods will not lead to the same level of significance for a given comparison.

(535:343)

Therefore, the question then became one of deciding which technique to use for the analysis of the data in this study. From a brief overview of the material at hand, the weight of authority seemed to lie with the Covariance Adjustment Technique. In Chapter IX of Design of Experiments, Professor R.A. Fisher discusses the different correction possibilities. (532) However, he himself then proceeds to use the Covariance Technique.

While it is theoretically rather easy to design an experiment utilizing groups which are comparable on important variables, in actual practice this becomes an exceedingly difficult task. Quite often, unalterable circumstances compel the use of groups which differ in respect to these important variables. In such cases, it is possible to make statistical allowances which permit valid inferences to be drawn.

It might be well to consider for a moment an example of such an occurrence in order to clarify just what is meant here. It might be stated, for example, that one fundamental objective of the Michigan State College Basic College is the development of the students' ability to think critically. Now, it might be desired to test the hypothesis that students in certain interest areas show greater gain in this ability during their freshman year in college than do students in other interest areas. However, a single test administered at the end of the freshman year in the Basic College cannot be used as a measure of group growth in this ability since such a test device would presumably reflect not only gain over the period of one year - but would also be a reflection of initial differences existing at the beginning of the year. This, of course, follows the assumption that students do not come to the College as tabulae rasae, but differ markedly in their ability to think critically at the time of their entrance into College. Thus, it becomes necessary to provide a pre-test of critical thinking ability at the beginning of the College year in order to obtain an indication of the existing initial differences. This, then, becomes a means by which final differences may be adjusted in order that an accurate estimate of group differences in gain over the period of the academic year might be made.

Table I is a summary of the steps involved in the process of Analysis of Variance by Covariance Adjustments as used in this study, together with a simplified presentation of the major formulae involved. In Table II a further explanation of this process is given in skeletal form.

TABLE I

ANALYSIS OF VARIANCE BY COVARIANCE ADJUSTMENTS
(Based upon McNemar, Table No. 62) (535:321)

Steps	Total	Within	Between
1. Sum of products	(A) $\sum_{ij} (x_{ij} - \bar{x})(y_{ij} - \bar{y})$	$\sum_{ij} (x_{ij} - \bar{x}_j)(y_{ij} - \bar{y}_j)$	$\sum_{kj} (\bar{x}_j - \bar{x})(\bar{y}_j - \bar{y})$
2. Sum of squares for Y's	(B) $\sum_{ij} (y_{ij} - \bar{y})^2$	$\sum_{ij} (y_{ij} - \bar{y}_j)^2$	$\sum_{kj} (\bar{y}_j - \bar{y})^2$
3. Sum of squares for X's	(C) $\sum_{ij} (x_{ij} - \bar{x})^2$	$\sum_{ij} (x_{ij} - \bar{x}_j)^2$	$\sum_{kj} (\bar{x}_j - \bar{x})^2$
4. Degrees of freedom	N - 1	N - k	k - 1
5. Correlation Coefficient	$\frac{A(\text{total})}{\sqrt{B(\text{total})} \sqrt{C(\text{total})}}$	$\frac{A(\text{within})}{\sqrt{B(\text{within})} \sqrt{C(\text{within})}}$	$\frac{A(\text{between})}{\sqrt{B(\text{between})} \sqrt{C(\text{between})}}$
6. Degrees of freedom for r	N - 2	N - k - 1	k - 2
7. b_{yx}	$A(\text{total})/C(\text{total})$	$A(\text{within})/C(\text{within})$	$[A(\text{between})/C(\text{between})]$
8. Adjusted sum of squares for "y"	$B(\text{total}) - A^2(\text{total})/C(\text{total})$ minus $B(\text{within}) - A^2(\text{within})/C(\text{within})$ = ADJUSTED B (between)		
9. Degrees of freedom	N - 2	N - k - 1	k - 1

Legend - Table I:

$\Sigma\Sigma$	=	sum of the sums
i	=	individual
j	=	joint or group (any particular group)
X	=	pre-test scores
$\bar{X}$	=	pre-test mean (grand mean)
$\bar{X}_j$	=	pre-test mean of any group
$\sum_{i=1}^j$	=	sum for groups considering the number of individuals (n) per group
k	=	number of groups

TABLE II

SEQUENCE OF OPERATIONS INVOLVED IN THE
ANALYSIS OF VARIANCE BY COVARIANCE ADJUSTMENT

1. Obtain the total Sums of squares or products - and then apply the correction terms.. - (For Total Group)

$$\text{ex. } \Sigma Y^2 - \frac{(\Sigma Y)^2}{N} ; \quad \Sigma X^2 - \frac{(\Sigma X)^2}{N}$$

$$\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{N}$$

2. Obtain the Between Groups Sums of squares or products - and then apply the correction terms.

$$\text{ex. } \frac{(\Sigma Y_1)^2}{n_1} + \frac{(\Sigma Y_2)^2}{n_2} + \dots + \frac{(\Sigma Y_j)^2}{n_j} - \frac{(\Sigma Y)^2}{N}$$

3. Obtain the Within Groups Sums of squares or products
= (Total sums, etc.) minus (Between Sums, etc.).

4. Develop the following data:-

Source of Variation	Degrees of Freedom	SSX "C"	S $\sqrt{XY}$ "A"	SSY "B"	Degrees of Freedom	Error of Estimate	Mean Square
Total	N-1	C _T	A _T	B _T	N-2		
Between	k-1	C _B	A _B	B _B	k-1	*	*
Within	N-k	C _W	A _W	B _W	N-k-1	**	**
							$\frac{k-1}{N-k-1}$

¹ Adjusted sum of squares for Y (post-test).

$$\text{Error of Estimate} = B - \frac{A^2}{C}$$

$$\text{Total Error of Estimate} = B_T - \frac{A_T^2}{C_T}$$

$$\text{Between Error of Estimate}$$

$$= \text{Total}_{E. \text{ of } R.} - \text{Within}_{E. \text{ of } R.}$$

$$F = \frac{\text{Adj. Mean Scores (Between)}}{\text{Adj. Mean Scores (Within)}}$$

$$= \frac{\frac{*}{k-1}}{\frac{**}{N-k-1}}$$

A rather complete and thorough discussion and explanation of the whole process of Analysis of Variance by the Covariance Adjustment Method may be found in McNemar, Chapter XV. (535:318-330)

Selection of the Sample

The group or sample population used for the purposes of this study was selected from all Freshman men and women students entering Michigan State College at the beginning of Fall Term, 1951. All entering freshmen were utilized for one or another of the several research designs being conducted by the Cooperative Study; however, the extensiveness of the total test battery rendered impractical the possibility of administering all tests to all subjects. Therefore, groups or clusters of students were selected more or less at random as they came through the registration process, and were assigned to one or another of the research designs. Thus only a portion of the total entering freshmen were used by the particular research design utilizing the three test instruments with which this dissertation is concerned. However, it is with this particular portion of the total group that this study is most directly concerned.

This entire pre-testing program had been carried out prior to the inception of this study, so that when it was decided to proceed with this supplemental research plan, permission was obtained from the Cooperative Study to make use of the samples used and raw data already obtained.

Thus, from a maximum potential population of 1942 students entering Michigan State College as freshmen in the Fall of 1951, 896 were available for purposes of this study. These 896 students represented the total number of cases that had completed all three tests during the Cooperative Study pre-testing program, and for whom complete and usable biographical data was available.

In Tables III and IV an explanation of the numbers of subjects involved in both the Fall pre-testing and the Spring post-testing programs is given.

TABLE III

Number of Subjects in Fall Pre-Testing Program

Initial Working Population for this Study	896
Population utilized by other research designs	1046
Total Freshman population tested by <u>Cooperative Study</u>	<u>1942</u>

TABLE IV

Number of Subjects At Time of Spring Post-Testing Program

Final working population utilized by this study	596
Drop-Outs during the academic year	118
Special Permission Students and Absentees	<u>182</u>
Total	896

The next step, therefore, appeared to be the need for establishing whether or not the final population used was truly representative of the entire freshman population. It was decided to try to establish this on the basis of their total scores obtained on the American Council of Education Psychological Test. It was also decided to utilize for this

purpose, the Chi-Square (χ^2) test of goodness of fit. That is, to check whether within the limits of chance sampling, the frequency distribution of this final working group is of the same type as that of the total population. Or, in other words, whether the observed frequency curve for this working sample can be fitted to that obtained from the data available for the whole freshman population tested.

Before proceeding with the statistical treatment and the results obtained therewith, it would probably be pertinent at this point to digress for a moment and to consider the method by which the scores on the A.C.E. Psychological Test were handled. These scores are the results of tests administered during Orientation Week as a part of the regular college-entrance examinations, and are taken directly from the official listing of the Michigan State College Board of Examiners. The raw scores were converted into Derived Scores based upon Michigan State College norms for the 1949 edition of the A.C.E. Psychological Test.

Table V shows the A.C.E. Psychological, - "Total", "L" and "Q" raw scores; the Derived Scores; the percentage of cases included in each category, and the percentage of students at or below each Derived Score Category.

TABLE V

Derived Scores	A.C.E. Psychological Test "Total" Score	"L" Score	Raw Scores "Q" Score	% of Cases in each Category	% of Students at or below each Der.Sc. Category
1	0-54	0-33	0-14	1	1
2	55-69	34-40	15-23	3	4
3	70-82	41-48	24-31	8	12
4	83-94	49-56	32-36	16	28
5	95-105	57-64	37-41	22	50
6	106-119	65-73	42-46	22	72
7	120-132	74-84	47-52	16	88
8	133-144	85-94	53-57	8	96
9	145-159	95-104	58-64	3	99
10	160 and up	105 and up	65 and up	1	100

In other words, the "decile" scale has been replaced by a standard ten point scale of "derived" scores ranging from one (lowest), to ten (highest). This derived score scale results in a reduction of the number of individuals in the extremes and increases the number in the centre of the scale. Therefore, under this system the extreme scores become much more significant as indicators of superior or inferior ability.

Returning now to the subject of the computation of Chi-square tests of representativeness, after consultation with the Guidance Committee, it was decided to test the following sets of data:

1. Final working sample (n=596) vs. All Entering Freshmen tested (n=1942)
2. Final working sample (n=596) vs. Remainder of Freshmen tested (n=1046)
3. Final working sample (n=596) vs. Original "Fall Term" working sample (n=896)
4. Those in final working sample who had taken Critical Thinking Test - Form A (n=302) vs. those in final working sample who had taken Critical Thinking Test - Form B (n=294)

The data pertaining to Set No. 1, that is, the Final Working Sample (n=596) vs. All Entering Freshmen Tested (n=1942), was analysed as shown in Table VII.

TABLE VII

COMPUTATION OF CHI-SQUARE TEST OF REPRESENTATIVENESS BETWEEN THE FINAL WORKING SAMPLE (N=596), AND ALL ENTERING FRESHMEN TESTED (N=1942)

Derived Scores ACE "Totals"	"All" Freshmen a'	Final Working Sample a	a + a'	$P = \frac{a}{a+a'}$	aP
0	10	1	11	.09091	.09091
9	50	11	61	.18033	1.98363
8	127	31	158	.19620	6.08220
7	270	62	332	.18675	11.57850
6	487	179	666	.26877	48.10983
5	434	133	567	.23457	31.19781
4	315	104	419	.24821	25.81384
3	161	51	212	.24057	12.26907
2	72	22	94	.23404	5.14868
1	16	2	18	.11111	.22222
	1942 n ₂	596 n ₁	2538	$\bar{P}$	142.49689 $\Sigma(aP)$

$$\bar{P} = \frac{n_1}{n_1 + n_2} = \frac{596}{2538} = .23483$$

$$\bar{q} = .76517$$

$$\begin{aligned} \chi^2 &= \frac{1}{\bar{P} \bar{q}} [\Sigma(aP) - (n_1 \bar{P})] = \frac{1}{(.23483)(.76517)} [142.49689 - (596)(.23483)] \\ &= \frac{1}{.17969} [142.49689 - 139.95868] \\ &= (5.56514)(2.53821) \\ &= 14.125494; \text{ with } 9^\circ \text{ freedom } < 16.919 \text{ at } .05, \text{ or } 21.666 \text{ at } .01. \end{aligned}$$

There is, therefore, no significant difference at either the 1% or the 5% levels of confidence between the final working sample and all entering Freshmen Tested.

The data for the other three sets were analysed in a similar manner with the following results:

1. There is no significant difference at either the 1% or the 5% levels of confidence between the final working sample (n=596) and all entering freshmen tested (n=1942).
2. There is no significant difference at either the 1% or the 5% levels of confidence between the final working sample (n=1046). (See Appendix - Table I)
3. There is no significant difference at either the 1% or the 5% level of confidence between the final working sample (n=596) and the original Fall Term working sample (n=396). (See Appendix - Table II)

It would appear, therefore, that, within the limits of chance sampling, the frequency distribution of the final working sample is of the same type as that of the total freshmen population. In other words, within the limits of chance sampling, it may be stated that the final working sample can be considered as representative of the total freshman group tested.

Further in view of the fact that, as has been previously stated, it was discovered that Form B of the Critical Thinking Test could not be considered sufficiently valid for the purposes of this study and therefore all statistical evaluations for the Critical Thinking Test would have to be based on the results of the Form A group alone, it seemed advisable to test the relationship between the groups that had taken each form. This was done in the same manner as has already been described, and no significant difference was discovered at either the 1% or the 5% level of confidence between the frequency distributions of the two groups. (See Appendix - Table III.)

Collecting and Assembling the Data

a) Pre-testing and Post-testing Programs:

Having considered the questions of the statistical design of the study, and of the selection and representativeness of the sample, it would now probably be pertinent to consider the manner in which the data were collected and assembled.

Permission was obtained from the Cooperative Study for the use of pre-test results obtained in the 1951 Fall Term pre-test program for the population used in this investigation. Test scores for the individuals concerned were taken directly from the scored test-sheet, and entered on the data sheet. At the same time lists were prepared showing the individuals' names, student numbers, and the form of the Critical Thinking Test which was administered to them. This last item was of importance in planning the administration of the post-testing program.

The development and planning of the post-testing program posed a great many administrative problems since major emphasis had to be given to the need of assuring an adequate and representative post-test sample. A pilot plan run early in the Spring of 1952 soon showed the low response that would result from a voluntary test-administration idea, and attention was therefore given to the possibility of obtaining and utilizing released class time for the purposes of post-test administration.

Since it had already been decided by both the Cooperative Study and the Michigan State College Board of Examiners to administer the Test of Critical Analysis in Reading and Writing as a part of the Spring Term Comprehensive testing program in the Department of Communication Skills, there was no need for further concern in this area. However, as

has been mentioned previously in the discussion of possible limitations of the study, a complicating factor of motivation was introduced at this point.

As preliminary investigations had shown that a greater percentage of the population could be reached for re-test purposes through the Department of Communication Skills than through any other Basic College Department, the cooperation of this department was obtained for this purpose.

This resulted in one two-hour laboratory period in each of the seventy-two sections of Communication Skills 113, that is, in the third term of the basic course, being made available for the purposes of the post-testing program during the last week in May, 1952. In order that each individual might be given the same form of the Critical Thinking Test as had been administered during the Fall pre-testing program, special care was taken to match student names and numbers on the revised class lists with the lists prepared earlier.

These prepared lists, with correct test forms added, were then given to the individual class instructors together with detailed instruction sheets, the short supplementary questionnaire, and packets of tests and answer sheets. In addition, in order that the procedure of test administration be as uniform as possible, a meeting was held with the members of the staff of this department in order to orient them to the purposes of the study and to the administrative procedures desired.

All students in the classes were given the tests, regardless of whether or not they had been included in the original sample population. It was felt that this would be preferable from the standpoint of motiva-

tion and classroom morale. The data for these "non-sample" cases were turned over to the Cooperative Study. Samples of the prepared class lists, the supplementary questionnaire, and instructions to the classroom instructors, are all included in the Appendix.

b) The Data Sheet and I.B.M. Card

In order to facilitate the collection of data and the preparation of such data for transfer to I.B.M. cards, a so-called "data sheet" was developed. Provision was made for this sheet to include not only data pertaining to the two parallel studies, i.e., both this and the Pike Study, but also some additional related data that may possibly be used in further research at a later date. (See Sample in Appendix.)

One such data sheet was prepared for each individual, and not only provided a convenient means for the collection and assembly of data, but also provided a form on which such data could be coded. In order to facilitate further the transfer of the coded data to the I.B.M. cards, column numbers were also placed on the data sheet referring to the appropriate I.B.M. columns in which the coded data were to be inserted. An example of such a code sheet is included in the Appendix.

To explain further both the functioning of this data sheet and the manner in which the raw data was handled it is now proposed to discuss briefly each entry together with its code.

The name of the individual was written in at the top of the data sheet for identification purposes in those situations where data were available and identifiable by student name only. This applied particularly to the data obtained from the Board of Examiners and from the post-testing program.

The case number assigned to each individual is the same number as that assigned and used by the Cooperative Study. This makes possible the easy and rapid checking and exchange of data with that group. Two groups or series of cases may be distinguished in this study. One group, administered Form A of the Critical Thinking Test, is identified by the code symbol "0" in column one, while the second group, given form B of the Critical Thinking Test, is identified by the code number "5". The following three code numbers, in columns two, three, and four of the I.B.M. card refer to the case number. The complete case number, including the group designation is therefore to be found in columns one to four inclusive.

The age of the individual is coded in column five according to the following code: an individual of age 16 is coded "0", a 17-year-old would be coded "1", an 18-year-old would be coded "2", and so on up to a subject 25 years of age and older - who would be coded "9".

The material in columns seven and eight pertain to the size of home community and to the father's occupation respectively, and is used in the Pike Study.

Column nine was coded according to the students' college status, that is, freshmen were coded "1", sophomores "2", etc. Although all cases used in this study were freshmen, during the testing program some transfer students and upper-classmen were accidentally included, and were later sorted out by means of this code.

Columns 10, 11, 12, 13, and 15 were not used for the purposes of this study. Column 14, coded according to the size of the student's high school, was used in the Pike Study.

The raw scores obtained by the students on the American Council on Education Psychological Examination, 1949 edition, are shown in columns 16 to 27 inclusive. These scores, taken from the official published lists of the Board of Examiners, were arranged as follows. The "Total" raw score was coded directly in columns 16, 17, and 18, so that, for example, a total score of 113 would be coded as "1" - "1" - "3" in these columns. Similarly, the linguistic, or "L" sub-score was coded directly in columns 19, 20, and 21; and the Quantitative, or "Q" sub-score was coded directly in columns 22, 23, and 24.

These A.C.E. raw scores were then converted into Derived Scores, as has been previously explained, and were entered in columns 25, 26, and 27 according to the following plan: Derived Scores for A.C.E. "Total" score in column 25, Derived Scores for A.C.E. sub-score "L" in column 26, and Derived Scores for A.C.E. sub-score "Q" in column 27.

Raw scores obtained on the pre-test administration of the Critical Thinking Test were coded directly in columns 28 and 29, and raw scores obtained in the post-testing were coded directly in columns 30 and 31. Columns 32, 33, and 34 were used to indicate the change over the period of the year. The direction of change was indicated in column 32, with a code "1" representing an increase or gain, and a "2" representing a decrease or loss over the period of one year, and the actual amount of the change was recorded in columns 33 and 34. Thus, a gain over the one-year period of 12 raw-score points would be coded and recorded as "1" - "1" - "2".

Columns 35 through 39 inclusive, and column 62, were used for indicating preference or interest areas. Columns 35 and 36 were used

for Fall Term preference, or interest area, and columns 37 and 38 for the Spring Term preference or interest area. These preference or interest areas were coded according to the following plan:

- 01 - Agriculture and Forestry
- 02 - Business and Hotel Administration
- 03 - Engineering
- 04 - Home Economics
- 05 - Fine Arts
- 06 - Elementary Education
- 07 - Language and Literature
- 08 - Social Science and Social Service
- 09 - No preference
- 00 - Nursing Education, Pre-Veterinarian, Pre-medical, Pre-dental.
- X or 11 - Biological Science and Physical Science.
- 12 - Miscellaneous - (not used in final study)

A rather important question which arose at this point concerned those students who had changed their indicated preference or major area of interest during the academic year. For this reason, two of the questions included in the short questionnaire which was administered at the time of the post-testing program were:

1. Have you changed major during the year? Yes.... No....
2. If you have made a change of major, please indicate what this change was, and when you made it.
 - a) from _____ to _____; date

_____	_____	_____
Fall	Winter	Spring
 - b) from _____ to _____; date

_____	_____	_____
Fall	Winter	Spring

After considerable deliberation, and discussion with the Guidance Committee, it was decided to accept the area in which the student had been enrolled for the greater part of the school year as the major interest area for that year. Thus, if a student had changed his preference at

the end of Fall Term, the area in which he had been enrolled during the Winter and Spring Terms would be considered the major interest area for the entire year. However, if a student had changed his preference at the beginning of or during the Spring Term, the area in which he had been enrolled for the Fall and Winter Terms would be considered the major interest area for the entire year.

Column 39 was used for the purpose of indicating which coded preference was to be used as the major area of interest. The coded symbol "5" indicated that the preference shown in columns 35 and 36 was to be used, while the code symbol "7" indicated that the preference shown in columns 37 and 38 was to be used.

Later, in order to facilitate the statistical work involved, the preference or major area of interest area finally selected for use was re-coded and entered in column 62. The code used here was the same as that used previously with the exception that the "0" prefix was dropped together with the designation for the miscellaneous group which was not to be used in the final evaluation.

In a manner similar to that previously described for the Test of Critical Thinking scores and changes, the Inventory of Beliefs pre-test scores were coded directly in columns 40, 41, and 42 and the post-test scores were coded directly in columns 43, 44, and 45; while the gains or loss over the period of the academic year were coded in columns 46, 47, and 48.

The scores on the Test of Critical Analysis in Reading and Writing also were handled in a similar manner, with the pre-test scores coded in columns 55 and 56, the post-test scores in columns 57 and 58, and

the gains or loss in columns 59, 60, and 61.

Columns 48 to 54, inclusive, were not used for the purposes of this research study and were coded "0". Columns 63 to 79, inclusive, were left for future research work and were not used at this time.

The cards applying to those cases in the initial sample who, for one reason or another, were not used in the final sample, were coded in column 80 according to the reasons why the case was not used.

For this purpose the following code was used:

- "1" - Dropped out of school
- "2" - Special Permission Students - who had earlier completed their Communication Skills requirements and who were therefore no longer available for re-testing.
- "3" - In school - but not re-tested because of excused absence, illness, and so forth.
- "4" - Test data incomplete.

While these cases are not considered in this study, it is planned to utilize them in later research. For this reason it was considered necessary to mark these cards as noted above.

The coded information on the data sheets was then punched and verified on I.B.M. cards. (See Sample Card in the Appendix.) The cards were then sorted in different ways in order to secure the desired information. Summary data were secured by tabulator runs which summarized the size of sub-samples, sums of squares, and sums of cross-products for separate groups of students. The resulting data were then translated into the proper forms necessary to compute the required statistics and to make the desired statistical tests.

CHAPTER III

The Test Instruments

Having discussed the actual research problem itself, as well as some of the background of this study, including the related research programs, the statistical design, and the characteristics of the population sample, it would now probably be well to devote a little time to the individual test instruments and to the information and data concerning them that have been collected by the Cooperative Study.

The Test of Critical Thinking will be used in order to illustrate the manner in which the test instruments were developed.¹ It must be emphasised, first, that while this can be considered as typical for all instruments, there were certain factors involved in the development of each that necessitated slight variations from this procedure. In general, however, the process was quite similar.

During the meeting held in Pittsburgh, Pennsylvania, in December, 1949, in which the project was set up and organized, the persons attending divided themselves into six committees, (Humanities, Natural Science, Social Science, Communication Skills, Attitudes, Values and Personal Adjustment, and Critical Thinking), and discussed possible ways for the projects to proceed.

Each committee specified one objective, or a complex of objectives, in which the group felt there would be considerable interest, and this

¹ The historical resume presented here was developed from information collected by personal interviews with Dr. P. Dressel and Dr. L. Mayhew, of Michigan State College.

became the point of departure for all subsequent activity. For example, the committee on Critical Thinking developed a generalized statement to the effect that "it was desirable that students be able to think critically about matters with which they come in contact in the course of their day-to-day living." All subsequent work of the Critical Thinking Committee stemmed from this generalized objective.

After this a series of meetings was arranged, one for each of the six areas, and these took place during March and April, 1950. At these meetings the objectives set up in Pittsburgh were restudied, both to ascertain their meanings and implications, and to determine how an evaluation study oriented towards them could be developed. By way of example, the committee on Critical Thinking began by discussing what was being done to teach for Critical Thinking by each of the participating colleges, and also, what was being done in order to evaluate Critical Thinking abilities.

The committee then undertook a discussion of what was meant by Critical Thinking. This required the definition of the major behaviours which the group believed accompanied or entered into this ability. Care was taken at this point to ensure that these were not philosophical definitions, but behaviours necessary if a person were to do Critical Thinking. Recognizing the difference between Critical Thinking and Creative Thinking the group also realized the need for delimiting its field. Then a list of behaviours which were believed to be important to Critical Thinking was developed. The assumption underlying the activity of the group during all this time was that Critical Thinking is something other than just intelligence plus knowledge. The committee accepted the idea that Critical Thinking is a skill which requires, in addition to intelligence and some knowledge, something else - some other factor not

readily identified.

At this point, before going ahead with any plans for instrumentation, the group felt that it ought to become conversant with what had been done, and with what was being done, in the field of measurement of the trait of Critical Thinking. Therefore, during the Spring of 1950, the members of the committee investigated a considerable number of tests or devices which attempted, in one way or another, to assess this trait or ability. Among others, these included the Watson-Glazier Test, portions of the Yale Aptitude Battery, various tests developed at the University of Florida, portions of the A.C.E. Psychological Examination, and of the Ohio State Psychological Test. These instruments were examined to determine whether or not they could be used or adapted to assess this trait. During this same period, committee members were asked to observe, and to have other people observe, and to record situations in which people demonstrated either effective or ineffective Critical Thinking. What was actually involved here was a type of Critical Incident Technique which was of assistance to the committee in clarifying, in its collective mind, just what was really meant by Critical Thinking. This also provided the raw materials out of which the test exercises were eventually constructed.

During the 1950 summer workshop meeting the members of the committee reviewed the results of their investigation of the existing instruments mentioned above, and deciding that no available test met with precisely their needs and requirements, decided to attempt to construct such a test themselves. To this end the group prepared a list of specifics developing even more completely just what was meant by Critical Thinking.

At this workshop the committees in the three areas of Social Science, Humanities, and Natural Science also prepared such lists. Those four lists were now carefully compared, and an extremely large degree of parallelism was found to exist between the thoughts and ideas of all four groups.

After preparing the list of specifics concerning Critical Thinking the group moved to develop certain criteria for the evaluation instrument, such as (a) the test should not assume any particular body of subject matter knowledge on the part of the examinee; (b) the test should measure the Critical Thinking gains of the student as a result of a total program of general education rather than as a result of one course; (c) the vocabulary level of the test should be at about the 11th grade level.

Plans were then made for the accumulation of information concerning situations in which Critical Thinking had been demonstrated, and which could be used to elicit a demonstration of Critical Thinking skill on the part of students. Each of the members of the committee agreed to solicit such incidents from his colleagues on his home campus, and to prepare these in rough form. These were then submitted to students in order to obtain their reactions as to whether the students thought the situations did or did not elicit Critical Thinking ability. They also obtained information from the students concerning what they thought Critical Thinking ability was.

In this way the group members accumulated a great amount of material and information to be used at the winter meeting. This was held in Cincinnati, Ohio, in January, 1951. At this time the committee reviewed

the various situations brought by the members, in which Critical Thinking skill had been reflected, and then made definite plans for a test instrument. These plans included the development of a two-way chart, listing, along one axis, those aspects of Critical Thinking which they hoped to measure, and, along the other axis, the areas of human activity in which they believed these traits should be developed. This two-way chart yielded, on the matrix, a series of cells which provided a means for individuals to select certain definite areas in which they were to concentrate. Thus, for example, some members undertook to write test items in the area of problems involving the self and measuring the ability of a student to sense a problem, while others undertook to write test questions involving ability to formulate hypotheses, with respect to the area of imponderables of the universe.

In addition to actually constructing or writing test materials, committee members accepted responsibility for trying out these test materials on students in their own institutions, and for the collection of data on the results. This information, including the actual student responses in the case of open-end, free response questions, was accumulated and sent to the central office of the Cooperative Study.

All of these items were developed with respect to the cells on the two-way chart. In the late spring of 1951, the committee created a series of four trial tests out of the items which had been submitted. These trial forms, consisting of from 20 to 40 test questions, were then prepared and sent out to the participating members, and administered to students later in the spring. Finally, the results of the test administrations were collected and item-analysed.

On the basis of this item analysis, plus other collected information the committee undertook to prepare two semi-final forms of the test during the summer of 1951. These two forms were designated Forms A and B of the Critical Thinking Test.

The other five committees had been progressing along parallel lines, and by the summer of 1951 they too had test instruments ready. This, then, was the manner in which the test instruments were developed. It would now probably be most pertinent to consider some of the data concerning these instruments that have been collected by the Cooperative Study.

The Test of Critical Thinking - Form A.

The following data concerning the reliability, validity, inter-test correlations and item analysis of the Test of Critical Thinking - Form A, has been collected by the Cooperative Study.

Reliability:

While estimates of its reliability have not proven as high as might be desired, the Test of Critical Thinking - Form A has proven to be sufficiently stable for purposes of group measurement. The following coefficients of reliability have been obtained for four different groups of students.

(526:6)

TABLE VIII

Coefficients of Reliability - Test of Critical Thinking - Form A.

<u>Test Form</u>	<u>Method</u>	<u>Group</u>	<u>N</u>	<u>r</u>
A	Kuder-Richardson Formula No. 20	Freshmen	600	.84
A	"	Seniors	101	.71
A	"	Freshmen	135	.75
A	"	Freshmen	147	.73

Validity:

There are several means by which the validity of a new test may be inferred. One method, known as Inter-test Correlations, is to compare results obtained on the new instrument with results from other tests whose qualities are already known or established. A second method, or evidence of validity, is based upon a comparison of results obtained by the newly-developed test with human judgment of a person's possession of the same trait. "To the degree to which test results approximate the collective opinions of qualified judges...the test may be said to be valid." (526:11)

Inter-Test Correlations Between the Test of Critical Thinking - Form A, and Other Test Instruments

(As indicated in the Instructors' Manual for the
Test of Critical Thinking - Form G)(526:9-10)

TABLE IX (Fall, 1951)

Pre-test correlation coefficients indicating the lowest relationship which obtained in any college, the highest relationship which obtained in any college, the average relationship which obtained for all students, the number of institutions used in comparing high and low correlation coefficients, and the number of students on which the average correlation coefficient is based.

Test of Critical Thinking, A, with:	Lowest Correlation in Any College	Highest Correlation in Any College	Average Correlation*	No. of Colleges	No. of Students
ACE Psych. Exam.	.41	.73	.56	12	2171
Critical Thinking in Social Science	.47	.66	.59	12	2171
Problems in Human Rel.	.14	.39	.26	11	1853
Inventory of Beliefs	.12	.43	.25	12	2171

* Average based on r to Z transformation. (535:123-24)

TABLE X (Spring, 1952)

Post-test correlation coefficients, indicating the lowest relationship which obtained in any college, the highest relationship which obtained in any college, the average relationship which obtained for all students, the number of institutions used in comparing high and low correlation coefficients, and the number of students on which the average correlation coefficient is based.

Test of Critical Thinking, A, with:	Lowest Correlation in Any College	Highest Correlation in Any College	Average Correlation*	No. of Colleges	No. of Students
ACE Psych. Exam.	.46	.70	.54	5	743
Critical Thinking in Social Science	.55	.67	.62	5	743
Problems in Human Rel.	.20	.36	.25	4	505
Inventory of Beliefs	.05	.39	.22	5	743

* Average based on r to Z transformation (535:123-24)

TABLE XI

Correlations Obtained Between the Test of Critical Thinking, Form A, and Some Measures Used in Various Colleges Cooperating in the Study.

	<u>r</u>	<u>N</u>
Ohio State Psychological Test	.64	165
Yale Aptitude Battery (Verbal)	.65	166
Yale Aptitude Battery (Quantitative)	.52	166
Coop. General Culture Test	.50	165
Nelson Denny Reading Test		
Vocabulary	.37	150
Paragraph Comprehension	.50	150
Total	.56	150
General Educational Development Test, Form B, Social Studies	.56	150
General Educational Development Test, Correctness and Effectiveness of Expression, Form B	.47	150
Michigan State College Reading Test	.56	320

In seeking evidence of validity for the Test of Critical Thinking from inter-test correlations, it should be kept in mind that there does not exist an instrument purporting to measure the same traits about which the builders...were concerned. (526:9)

Keeping this in mind, together with the fact that quite obviously the test requires considerable verbal facility, one would assume that a fairly high relationship would be discovered with other test instruments involving that particular trait. An examination of Tables K, X, and XI, shows this to be the case.

One would also assume, since Critical Thinking is assumed to be or to require something other than pure intelligence, and since the Test of Critical Thinking is intended to measure something other than this intelligence, that correlations with measures of intelligence be found to be considerably less than perfect. This, too, is shown in the tables.

Another type of negative evidence lies in the low correlations discovered between the Test of Critical Thinking and the two Attitudes tests (Inventory of Beliefs and Problems in Human Relations).

Considering, now, the second method for obtaining evidence of validity, i.e., by comparison of test scores with judgments of teachers, and other qualified judges, the following evidence is noted in the Instructor's Manual. (526:11)

Results have uniformly substantiated the generalization that teachers and the test agree in a high proportion of cases in selecting the same students for the high and low levels of critical thinking respectively. At one college, for example, 90% of students rated high in critical thinking ability by their teachers scored above the 50th percentile on the Test of Critical Thinking, Form A. Eighty-two percent of the students rated low on their critical thinking ability scored below the 50th percentile.

Item Analysis

Post-test Item Analysis data are also available for tests administered to Michigan State College Freshmen in early June, 1952.

(See Appendix.) These data consist of (1) an index of discrimination

(comparison of the number of persons scoring high on the test who answered a particular question correctly to the number of persons scoring low on the test who answered the same question correctly), and (2) a percentage of difficulty (the percentage of the entire group tested who answered a particular item correctly).

Fifty-two of the fifty-seven test items show coefficients of discrimination of .20 or better, suggesting a fairly high degree of internal test consistency. The average discrimination of all items was .391. The average percentage of difficulty was .677. (Average based on r to Z transformation)..(535:123-24)

Test of Critical Analysis in Reading and Writing

The following data concerning the reliability, validity, inter-test correlations, and iter analysis of the Test of Critical Analysis in Reading and Writing have been collected by the Cooperative Study.

Reliability:

Estimates of the reliability...of the test were quite low, ranging from .62 to .67 based on the Kuder Richardson technique involving internal consistency. These low coefficients are attributable to a number of factors, the two major ones of which are probably the length of the test (40 items) and the difficulty of the test, which actually precluded numbers of students finishing work on it. (524:5)

Validity:

The validity of the Test of Critical Analysis in Reading and Writing is not completely established. However sufficient evidence is available to support a reasonable presumption of the validity of the instrument. (524:5)

Inter-Test Correlations between the Test of Critical Analysis in Reading and Writing and other Mental Measures show the following results: (524:5)

Correlation between the Test of Critical Analysis in Reading and Writing and:

A.C.E. Psychological Examination, "Q" Score	$\frac{r}{.35}$
A.C.E. Psychological Examination, "L" Score	.57
A.C.E. Psychological Examination, "Total" Score	.56
a general test of Critical Thinking Ability	.53
two different attitudes tests (<u>Inventory of Beliefs</u> and <u>Problems in Human Relations</u>)	.13

Since this is a test of reading and writing, a fairly high correlation is to be expected between it and such other measures of academic aptitude that tend to be linguistic in orientation. This is borne out in the correlations noted between the test and the "L" and "Total" scores of the A.C.E. Psychological Examination, and also in the correlation with the test of critical thinking ability which involves considerable verbal ability. Evidence on the negative side lies in the low correlations found between the Test of Critical Analysis in Reading and Writing and the two attitudes measures.

Since this test was designed to measure change or gain with respect to skills explicitly taught in college courses, another measure of test validity would be demonstrated by the ability of the instrument to detect and measure such change or gain over a designated period of time. As will be shown in the following chapter, this is precisely what was discovered in the course of this research, with significant change being

detected and measured by this instrument when applied to the subject population.

A further measure of evidence of test validity, (since this test is intended, in part, to measure ability to write effectively), is shown by a comparison of scores obtained on this instrument with a composite grade given for a series of written exercises or themes. In one study, with N=60, the correlation was .58. (524:6)

Item Analysis Data:

Post-test Item Analysis data are also available for tests administered to Michigan State College Freshmen early in June, 1952, during the post-testing program. (See Appendix)

Thirty-five of the forty test items show coefficients of discrimination of .20 or better, suggesting a fairly high degree of internal test consistency. The average discrimination of all items was 34.7.* The average percentage of difficulty was 47.3.

*Average based on r to Z transformation. (535:123-24)

Inventory of Beliefs

The following data concerning the validity, reliability, inter-test correlations, and item analysis of the Inventory of Beliefs has been collected by the Cooperative Study.

Reliability:

The data presented in the Instructor's Manual for the Inventory of Beliefs concerning the reliability of this instrument would seem to indicate that the inventory is sufficiently stable for use on either a group or an individual basis. (527:6). A summary of these data is shown below.

TABLE XII

Summary of Studies of Reliability for the Inventory of Beliefs Form I

<u>Pre or Post-test</u>	<u>Method</u>	<u>N</u>	<u>r</u>
Pre	Kuder-Richardson	106	.90
Post	Kuder-Richardson	134	.85
Pre	Kuder-Richardson	101	.81
Pre	Kuder-Richardson	370	.88
P- and P.	Test-Retest - 9 months interval	186	.71
P- and P.	Test-Retest - 9 months interval	77	.77
P- and P.	Test-Retest - 9 months interval	263	.73
Pre	Split Half	370	.88
Pre	Split Half	370	.90
Pre	Split Half	205	.92
Pre	Split Half	120	.88
Post	Split Half	96	.93
Pre	Split Half	103	.90
Pre	Split Half	43	.95
Pre	Split Half	146	.91

Validity:

Because the Inventory of Beliefs is designed to serve two purposes - one related to the achievement of the objectives of general education and the second related to personality dimensions which are, at one and the same time, the psychological base for and the product of effective general education...the case for validity is presented under both these headings. (527:9)

A. The evidence for validity in terms of the objectives of general education, in addition to the fundamental requirement of face validity

for all items selected for inclusion in the Inventory, was obtained by the use of two groups of individuals drawn from several of the participating colleges.

The first group of approximately 30 were all individuals who were actively participating in a program of general education. They were asked to respond to each item in the Inventory according to the following instructions. (527:9)

Keeping in mind the desirable values and results of a good liberal or general education, how would you hope that a person who exemplifies them would respond to each of these statements? Record your responses according to the following key:

1. He should strongly agree or accept the statement.
2. He should tend to agree or accept the statement.
3. He should tend to disagree or reject the statement.
4. He should strongly disagree or reject the statement.

The results of this investigation showed that more than 80 per cent of these individuals agreed that approximately 100 of the 120 items could be classified as relevant to the objectives of general education. (527:9)

The second group of approximately 30 were specialists in some one of the areas related to the content of the Inventory, such as religion, psychology, philosophy, social science, etc. They were asked to respond to each item according to the following key:

1. The weight of evidence or expert opinion definitely supports this.
2. The weight of evidence or expert opinion generally tends to support this.
3. The weight of evidence or expert opinion generally tends to be against this.
4. The weight of evidence or expert opinion is definitely against this.
5. This statement cannot be classified in either direction.

The results of this investigation showed that a majority of the judges in the related areas agreed that almost three-fourths of the items could be regarded as generalizations or concepts based on relevant knowledge. (527:9)

B. The evidence for validity in terms of psychological dimensions is based upon two types of obtained data: (1) correlation with other tests, and (2) analyses of differences between extreme scorers.

(1) Inter-Test Correlations Between the Inventory of Beliefs and Other Test Instruments

(as indicated in the Instructor's Manual for the Inventory of Beliefs)
(527:10-11)

TABLE XIII (Fall, 1951)

Pre-test correlation coefficients indicating the lowest relationship which obtained in any college, the highest relationship which obtained in any college, the average relationship which obtained for all students, the number of institutions used in comparing high and low correlation coefficients, and the number of students on which the average correlation coefficient is based.

Inventory of Beliefs with:	Lowest Correlation in any College	Highest Correlation in any Col.	Average Correlation*	No. of Colleges	No. of Students
A.C.E. Psych.Exam.	.23	.46	.35	5	641
Critical Thinking-A	.12	.43	.25	12	2171
Critical Thinking in Social Sciences	.21	.44	.36	5	641
Problems in Human Relations	.13	.50	.35	5	641

*Average based on r to Z transformation. (535:123-24)

TABLE XIV (Spring, 1951)

Post-test correlation coefficients indicating the lowest relationship which obtained in any college, the highest relationship which obtained in any college, the average relationship which obtained for all students, the number of institutions used in comparing high and low correlation coefficients, and the number of students on which the average correlation coefficient is based.

Inventory of Beliefs with:	Lowest Correlation in any College	Highest Correlation in any College	Average Correlation*	No. of Colleges	No. of Students
A.C.E. Psych.Exam.	.13	.28	.19	4	452
Critical Thinking - A	.05	.39	.22	5	743
Critical Thinking in Social Sciences	.29	.39	.33	4	452
Problems in Human Relations	.19	.44	.31	3	252

*Average based on r to Z transformation. (535:123-24)

As is evident from these results - there seems to be but little positive correlation between the Inventory of Beliefs and measures of more intellectual or cognitive factors. This, in strong contrast to the results obtained for the Test of Critical Thinking or the Test of Critical Analysis in Reading and Writing supports the contention of the non-cognitive nature of the factors being measured by the Inventory.

(2) Comparison of Extreme Scorers

In terms of the initial premises upon which the Inventory was based, persons with extreme low scores (i.e., accepting many statements) might be presumed to represent an atypical segment of a college population. This assumption led to inquiry with respect to differences between very low and very high scorers on the test. As a result of such inquiry a considerable body of data has been accumulated which either directly supports, or does not contradict, the conclusion that the Inventory does measure certain types of personality structure... (527:11)

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Item Analysis Data

Post-test item analysis data are also available for tests administered to Michigan State College Freshmen in early June, 1952, during the post-testing program. (See Appendix)

Of the 120 test items 105 show coefficients of discrimination of .20 or better, suggesting a fairly high degree of internal consistency. The average discrimination of all items was .349.* The average percentage of difficulty was 54.1.

* Average based on r to Z transformation. (535:123-24)

CHAPTER IV

ANALYSIS OF THE DATA

As has already been mentioned in Chapter II, after the coded information on the data sheets had been punched and verified on I.B.M. cards, the cards were then run through the sorting and the tabulating machines. In this way data were secured which summarized the size of the sub-samples or sub-groups, the sums of squares and the sums of the cross-products for the different groups of students.

The statistical procedure outlined and discussed in Chapter II was then used in order to obtain the results which are presented in the following pages. This material is presented in the manner used in the previous chapter for the presentation of test data and other information collected by the Cooperative Study. That is, the material is presented separately for the Test of Critical Thinking, Form A; for the Test of Critical Analysis in Reading and Writing; and for the Inventory of Beliefs.

In presenting these data, the following code designations are used to represent the various preference categories, or major areas of study into which the sample is divided:

TABLE XV

CODE DESIGNATIONS FOR THE VARIOUS PREFERENCE CATEGORIES

<u>Code Designation</u>	<u>Preference Group or Major Area of Study</u>
1	Agriculture and Forestry
2	Business and Hotel Ad- ministration
3	Engineering
4	Home Economics
5	Fine Arts
6	Elementary Education
7	Language and Literature
8	Social Science and Social Service
9	No Preference
0	Pre-Medical; Pre-Dental; Pre-Vet.; Medical Technology; Nursing Education
**11	Biological Science and Physical Science
*12	Miscellaneous (all others)

* After discussion with the Guidance Committee, it was decided not to include the data obtained for this category or group of students in the statistical analysis, since information obtained for such a conglomerate grouping would tend to lack significant meaning. Therefore the totals given do not include data for this category.

** In the analysis of the data for the Test of Critical Thinking, Form A, it was decided, after consultation with the Guidance Committee, not to

use the data for this group in the statistical analysis because of the small "N" in the sample, (N=3). This, however, does not pertain to the analysis of the data for the other two test instruments where the total "N" for this particular group is 17. Therefore the totals given for the Test of Critical Thinking, Form A do not include either the data for this category, or the data for group coded 11 mentioned above.

TEST OF CRITICAL THINKING - Form A

Analysis of the Significance of the Difference Between the Total Group Means of the Pre- and Post-Test Scores on the Test of Critical Thinking - Form A

In developing the analysis of the significance of the difference between the total group means of the pre-test and post-test scores, it was necessary to take cognizance of the fact that "since the two means to be compared are based on the same individuals...the test of significance [of the difference between means], must make allowance for the fact that the two sets of scores are not random with respect to each other" (535:225).

Therefore, the analysis presented here is based upon the example given in McNemar (525:226).

$$"t" = \frac{x_1 - x_2}{\sqrt{\sigma_1^2 + \sigma_2^2 - 2r\sigma_1\sigma_2}}$$

where: σ_1 and σ_2 are standard errors of the means of pre- and post-test respectively. (Standard deviations of the means divided by $\sqrt{N}$)

r = coefficient of correlation between pre- and post- test
= .59979

x_1 = group post-test mean = 39.0941

x_2 = group pre-test mean = 31.8711

σ_1 = .46547; σ_1^2 = .21666

σ_2 = .37683; σ_2^2 = .14204

N = 237

$$\begin{aligned} "t" &= \frac{39.0941 - 31.8711}{\sqrt{(.21666 + .14204) - \frac{2}{(2)(.59979)}(.46547)(.37683)}} \\ &= 18.7586 \end{aligned}$$

Degrees of freedom = N-1 = 236

Entering a table of "t" values with 236 degrees of freedom, the required value of "t" at the 1% level of significance would be 2.592. The obtained value of "t" = 18.7586. It is therefore apparent that a significant difference exists between the total group means of the Pre- and Post-Test Scores on the Test of Critical Thinking - Form A.

Analysis of Variance by Covariance Adjustments,
for the Test of Critical Thinking - Form A for
Groups of Students in the Various Preference
Categories.

The Analysis of variance by Covariance Adjustment presented here is based upon the procedure described and outlined in Chapter II, Tables I and II. This procedure is also discussed rather thoroughly in McNemar, Chapter XV, (535:318-330).

The raw data upon which the calculations are based, that is, the sums of scores, sums of squares of scores, and cross-products of scores, are presented in the Appendix.

TABLE XVI

CALCULATION OF TOTAL SUMS OF SQUARES AND PRODUCTS AND CORRELATION COEFFICIENTS FOR THE TEST OF CRITICAL THINKING - FORM A.

	N = 287 Sums of Scores Mean Scores	A.C.E Psychological "TM" - Score X_1 30,207 105.2509	Critical Thinking Pre-Test Score X_2 9,147 31.8711	Critical Thinking Post-Test Score Y 11,220 39.0941
X_1	SX_1^2 , SX_1X_2 , SX_1Y Correction Terms, (SX_1^2/N) , SX_1X_2/N Deviations $\sqrt{SX_1^2}$, $\sqrt{SX_1X_2}$, $\sqrt{SX_1Y}$ Correlation Coefficients $r_{X_1X_2}$, r_{X_1Y}	3 282 471.0000 2 179 313.0627 103 157.9373 321.1821	982 800.0000 962 729.7178 20 070.2822 42 832.0419 .46858	1 197 590.0000 1 180 914.7732 16 675.2265 34 679.4124 .48084
X_2	SX_2^2 , SX_2Y Correction Terms (SX_2^2/N) , SX_2Y/N Deviations $\sqrt{SX_2^2}$, $\sqrt{SX_2Y}$ Correlation Coefficients r_{X_2Y} Std.dev. pre-test = $\sqrt{SX_2^2/N-1}$		309 309.0000 291 524.7700 17 784.2300 133.3575 7.88561	366 230.0000 257 593.5192 8 636.4808 14 399.1827 .59979
Y	SY^2 Correction Term (SY^2/N) Deviations $\sqrt{SY^2}$ Std. deviation of post-test			450 294.0000 438 633.5401 11 658.4599 107.9743 6.3847

TABLE XVII

CALCULATION OF WITHIN GROUPS SUMS OF SQUARES AND PRODUCTS AND CORRELATION COEFFICIENTS FOR THE
TEST OF CRITICAL THINKING - FORM A.

Source of Variations	A.C.E. Psychological "T" - Score X_1	Critical Thinking Pre-Test Score X_2	Critical Thinking Post-Test Score Y
X_1 Deviations (from Table XVI) Correction Terms (for groups) Individuals Within Groups $\sqrt{SX_1^2}$, $\sqrt{SX_2^2}$, $\sqrt{SX_1 \sqrt{SY^2}}$ Correlation Coefficients $r_{X_1 X_2}$, $r_{X_1 Y}$	103 157.9373 <u>5 119.7829</u> 98 038.1544 313.1105	20 070.2822 <u>1 084.0896</u> 18 986.1923 <u>40 898.8692</u> .46422	16 675.2265 <u>650.5907</u> 16 024.6358 <u>32 699.0375</u> .49006
X_2 Deviations (from Table XVI) Correction Terms (for Groups) Individuals Within Groups $\sqrt{SX_2^2}$, $\sqrt{SX_2 \sqrt{SY^2}}$ Correlation Coefficient $r_{X_2 Y}$		17 784.2300 <u>722.3283</u> 17 061.9017 130.6212	8 636.4808 <u>646.5307</u> 7 989.9501 13 641.1507 .58572
Y Deviations (from Table XVI) Correction Term (for Groups) Individuals Within Group $\sqrt{SY^2}$			11 658.4599 <u>752.2243</u> 10 906.2356 104.4329

Calculation of Multiple-Correlation Coefficients - R^2

a) For the Total Group:-

(data from Table XVI)

$$b_{y1:2}^1 = \frac{r_{x1y} - [(r_{x2y})(r_{x1x2})]}{1 - (r_{x1x2})^2} = .25599$$

$$b_{y2:1}^1 = \frac{r_{x2y} - [(r_{x1y})(r_{x1x2})]}{1 - (r_{x1x2})^2} = .47984$$

$$R^2 \text{ (for Total group)} = (r_{x1y})(b_{y1:2}^1) + (r_{x2y})(b_{y2:1}^1) = .41079$$

b) Within Groups:-

(data from Table XVII)

$$b_{y1:2}^1 = \frac{r_{x1y} - [(r_{x2y})(r_{x1x2})]}{1 - (r_{x1x2})^2} = .27809$$

$$b_{y2:1}^1 = \frac{r_{x2y} - [(r_{x1y})(r_{x1x2})]}{1 - (r_{x1x2})^2} = .45662$$

$$R^2 \text{ (within groups)} = (r_{x1y})(b_{y1:2}^1) + (r_{x2y})(b_{y2:1}^1) = .40373$$

Calculation of Errors of Estimate - Sum of Squares - (E_{ss})

$$\begin{aligned} E_{ss} &= (1-R^2)(SY^2) \\ &= \text{For the total group} \quad 6869.2812 \\ &= \text{Within Groups} \quad 6503.0611 \end{aligned}$$

TABLE XVIII

CALCULATION OF ADJUSTED POST-TEST MEANS OF SCORES ON THE TEST OF CRITICAL THINKING

FORM A

(Adjusted for A.C.E. Psychological "T" Score and Critical Thinking Pre-Test Score Status..)

Group Code	"N" ACE Psych. "T"-Score Means	Dev. from Group Mean $\bar{x}_1$	$(b^1_{Y1:2})(\bar{x}_1)$	Crit. Th. Pre-Test Means	Dev. from group Mean $\bar{x}_2$	$(b^1_{Y2:1})(\bar{x}_2)$	Crit. Th. Post-Test Means - Y	YAD Adjusted Post Test Means	Rank* (Order of Adjusted Post-Test Means)
0	22 104.3636	- .8873	- .2468	32.3636	.4925	.22439	40.2727	40.29456	3
1	15 103.5333	-1.7176	- .4765	22.8333	.9955	.45451	41.0557	41.08974	1
2	48 102.0625	-3.1884	- .8855	31.1657	-.7044	-.32164	38.6657	39.87500	5
3	32 114.5250	9.3741	2.6084	34.5938	2.7227	1.24324	41.1563	37.30622	7
4	22 103.9091	-1.3418	-.37314	33.0455	1.1744	.53625	40.3182	40.15509	4
5	10 109.0000	3.7491	1.04259	32.4000	.5289	.24151	37.9000	36.61590	9
6	21 97.9048	-7.3461	-2.04288	32.1905	.3194	.14584	39.1429	41.03994	2
7	12 111.2500	5.9991	1.60829	34.5833	2.7122	1.23344	39.8333	36.92557	8
8	12 104.3333	- .9176	- .25518	27.6667	-4.2044	-1.91981	33.0833	35.25829	10
9	93 105.0753	- .1756	- .04883	30.8065	-1.0646	-.48612	38.5161	39.05105	6

Group Mean - A.C.E. Psych. "T"-Score = 105.2509

Group Mean - Critical Thinking Pre-Test = 31.8711

Group Mean - Critical Thinking Post-Test = 39.0941

$$\text{Adjusted Post-Test Mean } (Y_{AD}) = Y - [Z(b^1_{Y1:2})(\bar{x}_1)] - [Z(b^1_{Y2:1})(\bar{x}_2)]$$

*Since no significant difference was later discovered between the gains, or growth, of the various preference groups - this ranking, or order of adjusted post-test means between the various groups cannot be considered to have statistical significance - but may be considered merely as an indication of the trend of the gains.

TABLE XIX

ANALYSIS OF COVARIANCE AND TEST OF SIGNIFICANCE OF ADJUSTED PREFERENCE-
GROUP MEANS FOR THE TEST OF CRITICAL THINKING - FORM A.
(287 INDIVIDUALS IN 10 GROUPS)

Source of Variation	Degrees of Freedom	Gain		Multiple Correlation Coefficients R ²	Errors of Estimate		
		Sum of Squares	Mean Squares		Degrees of Freedom	Sum of Squares	Mean Squares
Total	286	11 658.4599		.41079	284	6 869.2812	
Error (within Groups)	277	10 906.2356	39.3727	.40373	275	6 503.0611	23.6475
Between Groups	9	752.2243	83.5805		9	366.2201	40.6911

$$F = \frac{40.6911}{23.6475} = 1.7207$$

Entering a table of "F" values with N= 275 and 9 degrees of freedom, the required value of "F" would be 1.91 at the 5% level of significance and 2.48 at the 1% level of significance.

It is therefore apparent that no significant difference exists between the gains of the groups of students in the various preference categories, insofar as the Test of Critical Thinking - Form-A is concerned.

TEST OF CRITICAL ANALYSIS IN READING AND WRITING

Analysis of the Significance of the Difference Between the Total Group Means of the Pre- and Post-Test Scores on the Test of Critical Analysis in Reading and Writing

Using the same formula as that utilized for the analysis of the difference between the Pre- and Post-Test scores of the Test of Critical Thinking:

$$"t" = \frac{X_1 - X_2}{\sqrt{\sigma_1^2 + \sigma_2^2 - 2r\sigma_1\sigma_2}}$$

where

σ_1	=	.17859	σ_1^2	=	.03189
σ_2	=	.19903	σ_2^2	=	.03961
r	=	.45837			
X_1	=	18.3058			
X_2	=	14.5132			
N	=	569			

$$"t" = \frac{18.3058 - 14.5132}{\sqrt{(.03189 + .03961) - 2(.45837)(.17859)(.19903)}} = 19.2264$$

Entering a table of "t" values with 568 degrees of freedom, the required value of "t" at the 1% level of significance would be 2.568. The obtained value of "t" was 19.2264. It would appear, therefore, that a significant difference exists between the Total Group Means of the Pre- and Post-Test Scores on the Test of Critical Analysis in Reading and Writing.

Analysis of Variance by Covariance Adjustments for the Test of
Critical Analysis in Reading and Writing for Groups of Students
in the Various Preference Categories.

The Analysis of Variance by Covariance Adjustment presented here is based upon the procedure described and outlined in Chapter II, Tables I and II. This procedure is also discussed rather thoroughly in McNemar, Chapter XV (535:318-330).

The raw data upon which the calculations are based, i.e., the sums of scores, sums of squares of scores, and cross-products of scores, are presented in the Appendix.

TABLE XX

CALCULATION OF TOTAL SUMS OF SQUARES AND PRODUCTS AND CORRELATION COEFFICIENTS
FOR THE TEST OF CRITICAL ANALYSIS IN READING AND WRITING

	N = 569 Sums of Scores Mean Scores	ACE Psychological		C.A.R.W.	
		"T" Score X_1 59 099 103.8647	Pre-Test Score X_2 8 258 14.5132	Post-Test Score Y 10 416 18.3058	
X_1	SX_1^2 ; SX_1X_2 ; SX_1Y Correction Terms, $(SX_1^2/N; SX_1X_2/N; \dots)$ Deviations $\sqrt{SX_1^2}$; $\sqrt{SX_1^2 SX_2^2}$; $\sqrt{SX_1^2 SY^2}$ Coefficients of Correlation, $r_{X_1X_2}$ r_{X_1Y}	6 349 327.0000 6 138 298.4200 211 028.5800 459.3785	877 362.0000 857 714.4850 19 647.5150 46 640.2857 .42126	1 104 502.0000 1 081 854.4534 22 647.5466 51 978.4016 .43571	
X_2	SX_2^2 ; SX_2Y Correction Terms $(SX_2^2/N; SX_2Y/N)$ Deviations $\sqrt{SX_2^2}$; $\sqrt{SX_2^2 SY^2}$ Correlation Coefficient r_{X_2Y} Std. deviation pre-test = $\sqrt{SX_2^2/N-1}$		130 158.0000 119 849.8489 10 308.1511 101.5291 4.26006	156 435.0000 151 169.2935 5 265.7065 11 487.9567 .45837	
Y	SY^2 Correction Term (SY^2/N) Deviation $\sqrt{SY^2}$ Std. deviation of Post-Test $\sqrt{SY^2/N-1}$			203 476.0000 190 673.2091 12 802.7909 113.1494 4.7476	

TABLE XXI

CALCULATION OF WITHIN GROUPS SUMS OF SQUARES AND PRODUCTS AND CORRELATION COEFFICIENTS
FOR THE TEST OF CRITICAL ANALYSIS IN READING AND WRITING

Source of Variations	ACE Psychological "Tm" - Score X_1	C.A.R.W. Pre-Test Score X_2	C.A.R.W. Post-Test Score Y
X_1 Deviations (from Table XX) Correction Terms (for groups) Individuals Within Groups $\sqrt{SX_1^2}$; $\sqrt{SX_1^2}$; $\sqrt{SX_1^2}$ $\sqrt{SY^2}$ Correlation Coefficients $r_{X_1X_2}$; r_{X_1Y}	211 028.5800 7 464.4044 203 564.1756 451.1809	19 647.5150 379.6715 19 267.8435 45 364.5957 .42473	22 647.5466 62.0670 22 585.4796 49 251.9099 .45857
X_2 Deviations (from Table XX) Correction Terms (for groups) Individuals Within Groups $\sqrt{SX_2^2}$; $\sqrt{SX_2^2}$ $\sqrt{SY^2}$ Correlation Coefficient r_{X_2Y}		10 308.1511 198.6699 10 109.4812 100.5459	5 265.7065 13.0144 5 252.6921 10 975.8168 .47857
Y Deviations (from Table XX) Correction Term (for groups) Individuals Within Groups $\sqrt{SY^2}$			12 802.7909 886.3986 11 916.3923 104.4329

Calculation of Multiple-Correlation Coefficients - R^2

A) For the Total Group:-

(data from Table XX)

$$b_{y1:2}^1 = \frac{r_{x_1y} - [(r_{x_2y})(r_{x_1x_2})]}{1 - (r_{x_1x_2})^2} = .29496$$

$$b_{y2:1}^1 = \frac{r_{x_2y} - [(r_{x_1y})(r_{x_1x_2})]}{1 - (r_{x_1x_2})^2} = .33411$$

$$R^2 \text{ (for Total Group)} = (r_{x_1y})(b_{y1:2}^1) + (r_{x_2y})(b_{y2:1}^1) = .28167$$

B) Within Groups:-

(data from Table XXI)

$$b_{y1:2}^1 = \frac{r_{x_1y} - [(r_{x_2y})(r_{x_1x_2})]}{1 - (r_{x_1x_2})^2} = .31151$$

$$b_{y2:1}^1 = \frac{r_{x_2y} - [(r_{x_1y})(r_{x_1x_2})]}{1 - (r_{x_1x_2})^2} = .34627$$

$$R^2 \text{ (Within Groups)} = (r_{x_1y})(b_{y1:2}^1) + (r_{x_2y})(b_{y2:1}^1) = .30856$$

Calculation of Errors of Estimate - Sums of Squares - (E_{ss})

$$E_{ss} = (1-R^2)(SY^2)$$

$$= \text{For the total group } 9196.6288$$

$$= \text{Within groups } 8239.4703$$

TABLE AXII

CALCULATION OF ADJUSTED POST-TEST MEANS OF SCORES ON THE TEST
OF CRITICAL ANALYSIS IN READING AND WRITING

(Adjusted for A.C.E. Psychological Exam. "T_M" - Score and C.A.R. and W. Pre-Test Score Status)

Group Code	"N"	ACE Psych. "T _M "-Score Means	Deviation from group Mean X ₁	(b' y _{1:2})(X ₁)	C.A.R.W. Pre-test Means	Deviation from group Mean X ₂	(b' y _{2:1})(X ₂)	C.A.R.W. Post-Test means Y	Adjusted Post-Test Means	Rank (Order of adj. Post-Test Mns.)
11	17	110.4706	6.6059	2.05780	16.118	1.605	.55576	20.5290	17.9154	6
0	46	103.8913	.0266	.00828	14.022	-.491	-.17002	19.0220	19.1837	4
1	40	101.2750	-2.5897	-.80672	14.025	-.488	-.16898	18.4250	19.4007	2
2	96	101.1667	-2.6980	-.84045	14.448	-.065	-.02251	17.0210	17.8839	7
3	60	111.5667	7.7020	2.39925	14.600	.087	.03013	17.2670	14.8376	11
4	47	103.3617	-.5030	-.15669	14.085	-.428	-.14820	21.4890	21.7939	1
5	16	97.7500	-6.1147	-1.90479	14.000	-.513	-.17764	17.3130	19.3954	3
6	41	102.5123	-1.3524	-.42129	15.707	1.194	.41345	17.8290	17.8368	8
7	23	107.6522	3.7875	1.17984	16.000	1.487	.51490	19.2610	17.5063	9
8	22	109.8182	5.9535	1.85457	13.955	-.558	-.19322	17.0910	15.4297	10
9	161	102.2857	-1.5790	-.49187	14.348	-.165	-.05713	18.311	18.8600	5

Group Mean - A.C.E. Psychological "T_M" Score = 103.8647

Group Mean - C.A. in Reading and Writing Pre-Test = 14.5130

Group Mean - C.A. in Reading and Writing Post-Test = 18.3058

Adjusted post-test mean (Y_{AD}) = $Y - \frac{[(b' y_{1:2})(X_1)]}{[(b' y_{2:1})(X_2)]}$

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TABLE XXIII

ANALYSIS OF COVARIANCE AND TEST OF SIGNIFICANCE OF ADJUSTED PREFERENCE-GROUP MEANS FOR
THE TEST OF CRITICAL ANALYSIS IN READING AND WRITING
(569 Individuals in 11 Groups)..

Source of Variation	Degrees of Freedom	Gain		Multiple Correlation Coefficients R ²	Errors of Estimate		Mean Square
		Sum of Squares	Mean Square		Degrees of Freedom	Sum of Squares	
Total Error (Within Groups)	568	12 802.7909		.28167	566	9 196.62879	
Between Groups	558	11 916.3923	21.3555	.30856	556	8 239.47029	14.81919
	10	886.3986	88.63986		10	957.15850	95.71585

$$F = \frac{95.71585}{14.81919} = 6.45891$$

14.81919

Entering a table of "F" values, with N=556 and 10 degrees of freedom, the required value of "F" would be 1.85 at the 5% level of significance and 2.36 at the 1% level of significance.

It would appear, therefore, that a significant difference does exist between the gains of the groups of students in the various preference categories, insofar as the Test of Critical Analysis in Reading and

Writing is concerned.

INVENTORY OF BELIEFS

Analysis of the Significance of the Difference Between the Total Group Means of the Pre- and Post-Test Scores on the Inventory of Beliefs.

Using the same formula as that utilized for the analysis of the difference between the Pre- and Post-Test scores of the Test of Critical Thinking, and the Test of Critical Analysis in Reading and Writing:-

$$"t" = \frac{X_1 - X_2}{\sqrt{\sigma_1^2 + \sigma_2^2 - 2r\sigma_1\sigma_2}}$$

where	σ_1	=	.54981	σ_1^2	=	.30229
	σ_2	=	.59148	σ_2^2	=	.34985
	r	=	.68365			
	X_1	=	63.4060			
	X_2	=	56.4552			
	N	=	569			

$$\begin{aligned} "t" &= \frac{63.4060 - 56.4552}{\sqrt{(.30229 + .34985) - \sqrt{(2)(.68365)(.54981)(.59148)}}} \\ &= 15.25804 \end{aligned}$$

Entering a table of "t" values with 568 degrees of freedom, the required value of "t" at the 1% level of significance would be 2.568. The obtained value of "t" was 15.25804. It would appear therefore, that a significant difference exists between the Total Group means of the Pre- and Post-Test scores on the Inventory of Beliefs.

Analysis of Variance by Covariance Adjustments for the Inventory of Beliefs for Groups of Students in the Various Preference Categories.

The Analysis of Variance by Covariance Adjustments presented here is based upon the procedure described and outlined in Chapter II, Tables I and II. This procedure is also discussed rather thoroughly in McNemar, Chapter XV, (535:318-330).

The raw data upon which the calculations are based, i.e., the sums of scores, sums of squares of scores, and cross-products of scores, are presented in the Appendix.

TABLE XXIV

CALCULATION OF TOTAL SUMS OF SQUARES AND PRODUCTS AND CORRELATION COEFFICIENTS FOR THE INVENTORY OF BELIEFS

	N = 569 Sums of Scores Mean Scores	ACE Psychological w th Score X ₁ 59 099 103.8647	I. of B. Pre-Test Score X ₂ 32 123 56.4552	I. of B. Post-Test Score Y 36 078 63.4060
X ₁	SX ₁ ² ; SX ₁ X ₂ ; SX ₁ Y Correction Terms (SX ₁ ² /N; SX ₁ X ₂ /N) Deviations √SX ₁ ² ; √SX ₁ ² √SX ₂ ² ; √SX ₁ ² √SY ² Correlation Coefficient, r_{X_1Y}	6 349 327.0000 6 138 298.4200 211 028.5800 459.3785	3 362 260.0000 3 336 444.9508 25 815.0492 143 585.5949 .17979	3 778 249.0000 3 747 229.7399 31 019.2601 154 469.7875 .20081
X ₂	SX ₂ ² ; SX ₂ Y Correction Terms (SX ₂ ² /N; SX ₂ Y/N) Deviations √SX ₂ ² ; √SX ₂ ² √SY ² Correlation Coefficient r_{X_2Y} Std. Deviation pre-test = √SX ₂ ² /N-1		1 911 207.0000 1 813 509.8928 97 697.1072 312.5649 13.11493	2 108 643.0000 2 036 790.1476 71 852.8524 105 102.5107 .68365
Y	SY ² Correction Term, (SY ² /N) Deviation √SY ² Std. deviation post-test = √SY ² /N-1			2 400 630.0000 2 287 560.7803 113 069.2197 336.2582 14.1091

TABLE XXV

CALCULATION OF WITHIN GROUPS SUMS OF SQUARES AND PRODUCTS AND CORRELATION COEFFICIENTS FOR THE INVENTORY OF BELIEFS

Source of Variations	A.C.E. Psychological		I. of B.	
	WTW Score X_1	Pre-Test Score X_2	Post-Test Score Y	
X_1	Deviations (From Table XXIV) Correction Terms (for groups) Individuals Within Groups $\sqrt{SX_1^2}$; $\sqrt{SX_1^2}$; $\sqrt{SX_1^2}$; $\sqrt{SY^2}$ Correlation Coefficients, $r_{X_1X_2}$; r_{X_1Y}	211 028.5800 $\frac{7 464.4044}{203 564.1756}$ 451.1809	25 815.0492 $\frac{43.1865}{25 858.2357}$ 139 210.5983 .18575	31 019.2601 $\frac{1 134.6981}{29 884.5620}$ 147 531.8681 .20256
X_2	Deviations (From Table XXIV) Correction Terms (for groups) Individuals Within Groups $\sqrt{SX_2^2}$; $\sqrt{SX_2^2}$ Correlation Coefficient, r_{X_2Y}		97 697.1072 $\frac{2 495.7895}{95 201.3177}$ 308.5471	71 852.8524 $\frac{2 927.6132}{68 925.2392}$ 100 891.9705 .68316
Y	Deviations (From Table XXIV) Correction Term (for Groups) Individuals Within Groups $\sqrt{SY^2}$			113 069.2197 $\frac{6 148.4537}{106 922.7660}$ 326.9905

CALCULATION OF MULTIPLE-CORRELATION COEFFICIENTS - R²

a) For the Total Group: (Data from Table XXIV)

$$b'_{y1:2} = \frac{r_{x1y} - \frac{[r_{x2y}][r_{x1x2}]}{1 - (r_{x1x2})^2}}{1 - (r_{x1x2})^2} = .11511$$

$$b'_{y2:1} = \frac{r_{x2y} - \frac{[r_{x1y}][r_{x1x2}]}{1 - (r_{x1x2})^2}}{1 - (r_{x1x2})^2} = .47670$$

$$R^2 \text{ (for total group)} = (r_{x1y})(b'_{y1:2}) + (r_{x2y})(b'_{y2:1}) = .55705$$

* * *

b) Within Groups: (Data from Table XXV)

$$b'_{y1:2} = \frac{r_{x1y} - \frac{[r_{x2y}][r_{x1x2}]}{1 - (r_{x1x2})^2}}{1 - (r_{x1x2})^2} = .11552$$

$$b'_{y2:1} = \frac{r_{x2y} - \frac{[r_{x1y}][r_{x1x2}]}{1 - (r_{x1x2})^2}}{1 - (r_{x1x2})^2} = .46857$$

$$R^2 \text{ (Within Groups)} = (r_{x1y})(b'_{y1:2}) + (r_{x2y})(b'_{y2:1}) = .55411$$

* * *

CALCULATION OF ERRORS OF ESTIMATE - SUM OF SQUARES (E_{ss})

$$E_{ss} = (1-R^2)(S_y^2)$$

$$\text{For the total group} \quad E_{ss} = 50084.01087$$

$$\text{Within groups} \quad E_{ss} = 47675.79213$$

TABLE XXVI

CALCULATION OF ADJUSTED POST-TEST MEANS OF SCORES ON THE INVENTORY OF BELIEFS
(Adjusted for A.C.E. Psychological Exam. "T" - Score and I. of B. Pre-Test Status)

Group Code	"N" ACE Psych. "T" Score Means	Deviation from group Mean - X ₁	(b'y _{1:2})(X ₁)	I. of B. Pre-Test Means	Deviation from group Mean - X ₂	(b'y _{2:1})(X ₂)	Y I. of B. Post-Test Means	Adjusted Post-Test Means YAD	Rank (Order of Adj. Post-tst Means)
11	17	110.4706	6.6059	.7631	61.471	5.016	2.3503	71.768	1
0	46	103.8913	.0266	.0031	56.913	.458	.2146	60.173	11
1	40	101.2750	-2.5897	-.2992	56.575	.120	.0562	63.743	6
2	96	101.1667	-2.6980	-.3117	54.556	-1.799	-.8430	61.488	8
3	60	111.5667	7.7020	.8897	54.767	-1.683	-.7909	61.068	9
4	47	103.3617	-.5030	-.0581	61.085	4.530	2.1695	65.932	2
5	16	97.7500	-6.1147	-.7064	58.313	1.858	.8706	65.2108	4
6	41	102.5123	-1.3524	-.1562	55.610	-.845	-.3959	60.650	10
7	23	107.6522	3.7875	.4375	59.739	3.284	1.5388	62.502	7
8	22	109.8182	5.9535	.6877	53.318	-3.137	-1.4699	66.827	3
9	161	102.2857	-1.5790	-.1824	56.106	-.349	-.1635	64.532	5

Group Mean - A.C.E. Psychological "T" Score = 103.8647

Group Mean - I. of B. Pre-Test Score = 56.455

Group Mean - I. of B. Post-Test Score = 63.406

Adjusted Post-Test Mean (Y_{AD}) = $Y - \left[(b'_{y1:2})(X_1) \right] - \left[(b'_{y2:1})(X_2) \right]$

TABLE XXVII

ANALYSIS OF COVARIANCE AND TEST OF SIGNIFICANCE OF ADJUSTED PREFERENCE-GROUP MEANS FOR
THE INVENTORY OF BELIEFS
(569 Individuals in 11 Groups)

Source of Variation	Degrees of Freedom	Gain		Multiple Correlation Coefficients R^2	Degrees of Freedom	Errors of Estimate	
		Sum of Squares	Mean Squares			Sum of Squares	Mean Square
Total	568	113 069.2197		.55705	566	50 084.0109	
Error (Within Groups)	556	106 922.7660	191.6179	.55411	556	47 675.7921	85.74782
Between Groups	10	6 146.4537	614.6454		10	2 408.2187	240.82187

$$F = \frac{240.82187}{85.74782} = 2.8089$$

Entering a Table of "F" values with $N = 556$ and 10 degrees of freedom, the required value of "F" would be 1.85 at the 5% level of significance - and 2.36 at the 1% level of significance.

It would appear, therefore, that a significant difference does exist between the gains of the groups of students in the various preference categories, insofar as the Inventory of Beliefs is concerned.

SUMMARY OF RESULTS

A. Test of Critical Thinking - Form A.

This test instrument was administered to a re-test group of 287 students. All of these students had previously been given the same test during their first week in college, that is, during Orientation Week, 1951. The re-test was administered during the last week of classes at the end of May and beginning of June, 1952. Thus the intervening time was three full terms, or one academic year.

The total-group mean score on A.C.E. Psychological Exam. = 105.2509.

Critical Thinking Test Total group <u>pre-test mean</u>	=	31.8711.	
Max. possible score	=		57

Critical Thinking Test Total group <u>post-test mean</u>	=	39.0941	
Max. possible score	=		57

Applying the "t" - test of significance of the difference between the means of pre- and post-test scores, and with 286 degrees of freedom, the required value of "t" at the 1% level of significance would be 2.592. The obtained value of "t" was 18.7856. Therefore, it can be stated that a significant difference exists between the total group means of the pre- and post-test scores.

The standard deviation of the pre-test scores (for total group) = 7.8856

The standard deviation of the post-test scores (for total group) = 6.3847

The Coefficients of Correlation "r":-

<u>Between</u>	<u>For total Group Within Group</u>	
A.C.E. Psychological "Total" Score and Critical Thinking Pre-Test	.46858	.46422
A.C.E. Psychological "Total" Score and Critical Thinking Post-Test	.48084	.49006
Critical Thinking <u>Pre-Test</u> and Critical Thinking <u>Post-Test</u>	.59979	.58572

An Analysis of Variance (by the Covariance Adjustment technique), of the gains of the students in the 10 different preference-group or interest categories over a period of one academic year (with initial status or pre-test performance, and with scholastic aptitude as measured by the A.C.E. Psychological Examination as considered variables), showed that there was no significant difference between the gains of the various groups.. ($F = 1.7207 < 5\% \text{ level} = 1.91$)

* * *

B. Test of Critical Analysis in Reading and Writing

This test instrument was administered to a re-test group of 569 students. All of these students had previously been given the same test during their first week in college, that is, during Orientation Week, 1951. The re-test was given as part of the final year-end Comprehensive Examination in the Department of Communication Skills, during the early part of June, 1952. Thus the intervening period was three full terms, or one academic year.

The Total-group mean score on A.C.E. Psychological Examination = 103.8647.

C.A.R. and W. Total Group pre-test mean = 14.5132. Max. possible score = 40.

C.A.R. and W. Total Group post-test mean = 18.3058. Max. possible score = 40.

Applying the "t" test of significance of the difference between the means of pre- and post-test scores, and with 568 degrees of freedom, the required value of "t" at the 1% level of confidence would be 2.563. The obtained value of "t" was 19.2264. Therefore it can be stated that a significant difference exists between the total group means of the pre- and post-test scores.

The standard deviation of the pre-test scores, (for total group) = 4.260.

The standard deviation of the post-test scores (for total group) = 4.748.

The Coefficients of Correlation "r":-

<u>Between</u>	<u>For Total Group</u>	<u>Within Groups</u>
A.C.E. Psychological "Total" Score and C.A.R. and W. <u>Pre-Test</u>	.4213	.4247
A.C.E. Psychological "Total" Score and C.A.R. and W. <u>Post-Test</u>	.4357	.4586
C.A.R. and W. <u>Pre-Test</u> and C.A.R. and W. <u>Post-Test</u>	.4584	.4786

An Analysis of Variance (by the Covariance Adjustment technique), of the gains of the students in the 11 different preference-group or interest categories over a period of one academic year (with initial status or pre-test performance, and with scholastic aptitude as measured by the A.C.E. Psychological Examination as considered variables), showed that there are significant differences at the 1% level of confidence between the gains of the various groups. ($F = 6.4589 > 1\% \text{ level} = 2.36.$)

C. Inventory of Beliefs

This test instrument was administered to a re-test group of 569 students. All of these students had previously been given the same test during their first week in college, that is, during Orientation Week, 1951. The re-test was administered during the last week of classes at the end of May and beginning of June, 1952. Thus the intervening period was three full terms, or one academic year.

The Total-Group Mean Score on the A.C.E. Psychological Examination = 103.8647.

I. of B. total group pre-test mean = 56.4552. Max. possible score = 120.

I. of B. total group post-test mean = 63.4060. Max. possible score = 120.

Applying the "t" test of significance of the difference between the means of the pre- and post-test scores, and with 568 degrees of freedom, the required value of "t" at the 1% level of confidence would be 2.568. The obtained value of "t" was 15.2580. Therefore it can be stated that a significant difference exists between the total group means of the pre- and post-test scores.

The standard deviation of the pre-test scores (for total group) = 13.1149.

The standard deviation of the post-test scores (for total group) = 14.1091.

The Coefficient of Correlation "r".

<u>Between</u>	<u>For Total Group Within Groups</u>	
A.C.E. Psychological "Total" Score and I. of B. <u>Pre-Test</u>	.17979	.18575
A.C.E. Psychological "Total" Score and I. of B. <u>Post-Test</u>	.20081	.20256
I. of B. <u>Pre-Test</u> and I. of B. <u>Post-Test</u>	.68365	.68316

An Analysis of Variance (by Covariance Adjustment technique), of the gains of the students in the 11 different preference-group or interest categories over a period of one academic year (with initial status or pre-test performance, and with scholastic aptitude as measured by the A.C.E. Psychological Examination as considered variables), showed that there are significant differences at the 1% level of confidence between the gains of the various groups ($F = 2.8089 > 1\% \text{ level} = 2.36$).

* * *

A listing and a comparison of the order of adjusted post-test means of the various preference-groups or interest categories of students over a period of one academic year as measured by the Test of Critical Analysis in Reading and Writing, and by the Inventory of Beliefs, is given in Table XXVIII. These are adjusted for initial performance (pre-test status), and for scholastic aptitude (achievement on the A.C.E. Psychological Examination).

(Since no significant difference was discovered, in the area of Critical Thinking, between the gains of students in the various preference-group categories, a ranking of gains would lack any real or statistically-significant meaning, and is therefore not given.)

TABLE XXVIII

COMPARISON OF ADJUSTED POST-TEST MEANS AFTER PRE-POST TEST PERIOD OF ONE ACADEMIC YEAR.

Group Code	Preference or Interest Groups	C.A.W. (N=569)		I. of B. (N=569)	
		Rank*	Adjusted Post-Test Means	Rank*	Adjusted Post-Test Means
11	Biological and Physical Science	6	17.9154	1	71.768
0	Pre-Medical, -Dental, -Vet, Nursing Ed.	4	19.1837	11	60.173
1	Agriculture and Forestry	2	19.4007	6	63.743
2	Business and Hotel Administration	7	17.8839	8	61.488
3	Engineering	11	14.8376	9	61.068
4	Home Economics	1	21.7939	2	66.932
5	Fine Arts	3	19.3954	4	65.211
6	Elementary Education	8	17.8368	10	60.650
7	Language and Literature	9	17.5663	7	62.502
8	Social Science and Soc. Service	10	15.4297	3	66.827
9	No-Preference	5	18.8600	5	64.532

Post-Test Means have been adjusted for initial performance (Pre-Test), and for scholastic aptitude as measured by the A.C.E. Psychological Examination.

*Rank refers to standing of adjusted Post-Test Mean Score when compared with Post-Test Mean Scores of other groups.

CHAPTER V

Discussion of Results and Implications Arising From These Results

Statement of Research Objectives and Results

In terms of the specific objectives of this study, the results which follow were obtained through the use of the Test of Critical Thinking - Form A, the Test of Critical Analysis in Reading and Writing, and the Inventory of Beliefs, as developed by the committees of the Cooperative Study of Evaluation in General Education of the American Council on Education.

A. The first objective was to attempt to determine whether, over a period of one academic year, and within the areas of Critical thinking, Ability to do Critical Analysis in Reading and Writing, and Level of Maturity of Beliefs and Reactions, change or gain can be distinguished in Freshman students.

Considering the whole, or total-group population, (N=569 for the Test of Critical Analysis in Reading and Writing, and the Inventory of Beliefs, and N=287 for the Test of Critical Thinking - Form A), a significant change or gain, over a period of one academic year, was discovered in each of the three areas measured. (The differences between the pre- and post-test means were significant at the 1% level of confidence.)

B. The second objective was to attempt to determine whether, within the areas of Critical Thinking, Ability to do Critical Analysis in Reading and Writing, and Level of Maturity of Beliefs and Reactions, differences can be distinguished between the change or gain of Freshman Students in the various interest categories or major areas of study.

Considering the total population as divided into the various preference-group or interest categories, (i.e., declared or intended majors), and with (a) pre-test scores or initial status and (b) scholastic aptitude as measured by the A.C.E. Psychological Examination as variables:-

1) In the area of Critical Thinking there is no significant difference at the 5% level of confidence between the change or gains of students in the various categories.

2) In the area of Ability to do Critical Analysis in Reading and Writing, there are significant differences at the 1% level of confidence between the change or gains of students in the various categories.

3) In the area of Level of Maturity of Beliefs and Reactions, there are significant differences at the 1% level of confidence between the change or gains of students in the various categories.

Therefore, the results would seem to indicate that within their specific areas all three test instruments can be used as means of detecting or measuring change over a certain period of time of whole groups of students.

They would also seem to indicate that two of the instruments, (i.e., the Test of Critical Analysis in Reading and Writing and the Inventory of Beliefs), can be used as means of detecting or measuring differences

in the amount of change, within their own specific areas, between various sub-groups of students.

* * *

Test of Critical Thinking - Form A

At the present time it would be rather difficult to state whether or not the Test of Critical Thinking - Form A can be used as a means of detecting or measuring differences in change within the area of Critical Thinking between various sub-groups of students. The fact that in this study no significant differences were discovered in this area could conceivably have one of several possible implications.

The first is that while the test can detect and measure change within a group of students taken as a whole, it is not sufficiently sensitive to the subtle and distinctive differences involved in each of the smaller preference-groups to detect or measure the differences in change between the various sub-groups.

This would presuppose that within each of these sub-groups or preference-groups there is some common factor in terms of areas of interest which must be reached, and to which the test instrument must be sensitized, before a true measure of its change can be achieved. This, of course, immediately suggests the tremendous difficulty which would beset any attempt to reach and to measure more than one such interest area with a single all-encompassing instrument.

The second possible implication is the direct alternative to this line of reasoning. It would suggest that, since significant change within the area of Critical Thinking has been detected by means of this

instrument for the total group of students, the test instrument is sufficiently sensitive to measure differences between groups of students as well. The failure to discover differences in the amount of change between the various sub-groups is therefore due solely to the fact that no such significant differences in change or gain existed to be measured.

Stated another way, this line of reasoning suggests that students in all the various preference-group or interest categories gain or change equally within this area during the course of an academic year. If this be the case, then for this area at least, the program of general education in practice during the academic year 1951-1952 achieved its purpose with a fair degree of success.

It would be exceedingly difficult to state which of these two possible implications seems to be correct. In fact, it is quite possible that to a certain degree both are true. That is to say, it is quite possible that the amounts of gain made by the various groups are so nearly alike that the test instrument is not sufficiently delicate or sensitive to measure what slight differences do actually exist. (See Table XVIII, Chapter IV.)

A review of the coefficients of correlation "r", obtained for the Test of Critical Thinking - Form A, suggests several interesting points. Probably the most obvious is that, as has been stated in Chapter I, something other than a single ability is being measured. The correlations with the A.C.E. Psychological Examination on "Total" score certainly bear out the idea that this instrument is something other than a measure of academic aptitude. Furthermore, the data collected by the Cooperative Study and presented in Chapter III, Table XI, would seem to support the notion that this instrument does require a considerable degree of



verbal facility. Yet neither set of correlations is sufficiently large to suggest that a particular ability is being measured to the exclusion of others. But rather, the information collected thus far would seem to suggest that, while the factors involved in academic aptitude and the factor of verbal facility are involved in the complex of related-variables considered under the term "critical thinking", there are other unidentified factors involved whose effects are also being measured.

Regardless, however, of the isolation and identification of the actual factors concerned, there is no doubt that the variables or abilities previously defined as being involved in the concept of critical thinking as used in this research are among those abilities considered as the objectives or goals of a program of general education. And it is to such a program of general education that the subjects of this study have been exposed for a period of one academic year. It would seem then, that since highly significant differences between total-group pre- and post-test means are distinguished by this instrument, i.e., that the change or gains which for this reason are expected can actually be detected, that it may be assumed to be at least a partial validation of this particular instrument when used for the purpose of measuring the effect of a program of general education.

Test of Critical Analysis in Reading and Writing

As has already been pointed out, an examination of the results obtained in this study would seem to indicate that the Test of Critical Analysis in Reading and Writing can be used to detect or measure change of whole groups of students within this area. Furthermore, it would also seem that the instrument is sufficiently sensitive to distinguish

differences in the amount of change between various sub-groups.

Unlike the Test of Critical Thinking, which, in order to distinguish between the differences in group change, would probably have to reach some distinct and individual factor common to each particular interest sub-group, the Test of Critical Analysis in Reading and Writing need only reach the single cluster of factors, common to all groups, which is involved in ability to do critical analysis in reading and writing.

The rather low coefficients of correlation obtained between both pre- and post-test scores on this instrument and the A.C.E. Psychological Examination "Total" score would seem to indicate that, while academic aptitude or ability may be a factor in ability to do critical analysis in reading and writing, it is by no means the determining factor. Undoubtedly, just as the factor of verbal facility enters into the ability to do critical thinking, so the ability to do critical thinking enters into the ability to do critical analysis in reading and writing. In addition, other factors such as a certain amount of mechanical reading skill, skill or practice in retention of material read, vocabulary size, knowledge and understanding of the rules of grammar and composition, also enter into the cluster of abilities or factors measured by this instrument.

If, for the moment, the concept of relative stability of academic aptitude or ability over a period of one academic year may be accepted, then the effect of an academic year's work within that portion of a general education program which concerns itself with communication skills could be expected to manifest itself in just such factors as increased reading skills, increased ability to comprehend and retain the concepts or

ideas presented by the printed material, increased ability to recognize errors in comprehension and conceptualization made by others, and so on. Since the subjects of this study have all been exposed to such a portion of a program of general education, and since the expected change or gain has been detected to a significant degree, it is probably justifiable to assume that at least a partial validation of the use of this instrument to measure this portion of the total effect of a general education program has been achieved.

Inventory of Beliefs

The results obtained in this study through the use of this instrument would seem to indicate that the Inventory of Beliefs can be used to detect or measure change of whole groups of students within the areas of the students' relations to (a) ideas and intellectual abstractions, (b) social groups and identifications, (c) interpersonal relations, and (d) the self. Furthermore, it would also seem that the instrument is sufficiently sensitive to distinguish differences between the amount of change of various sub-groups when classified according to their preference or interest areas.

The extremely low coefficients of correlation between the pre- and post-test scores on the Inventory of Beliefs and the A.C.E. Psychological Examination "Total" score is additional evidence of the emotional and attitudinal nature of the factors being measured, or in other words, of their non-cognitive nature.

Since, as has already been stated:

The fundamental assumption underlying the Inventory of Beliefs is that the objectives of general education can serve as a base from which may be inferred the model organization characterizing the personalities of those most adaptable to the purposes of general education. (527:4)

and furthermore, since the members of the committee which constructed the Inventory

...conceived of attitudes as being one of the major clusters of outcomes of an entire general education program, or of a college program. Thus they were interested in the total impact of college on students rather than with the outcomes of specific courses.
(527:5)

it would therefore seem that change in the areas measured by this instrument could be anticipated. This is especially so in view of the fact that the students being measured have all been exposed to such a program of general education for at least one academic year, and also in view of the fact that the instrument itself

...consists of statements of opinion or belief which experienced college teachers felt ought to be affected by programs of general education.
(527:10)

Therefore, the detection not only of this anticipated change of the whole population, but also of normally expected differences in the amount of change between the various sub-groups, would seem to justify the assertion that at least a partial validation of the use of this instrument to measure this portion of the total effect of a general education program has been achieved.

* * *

Results of Ranking or Comparison of Gains

Probably that portion of the results of this research which can be discussed with the least amount of definitiveness or certainty, and yet which probably contains what may potentially be the greatest implication both for the general education program studied and for future research, is the portion concerned with the ranking or comparison of gains.

Since no significant difference was discovered between the gains or change in the area of critical thinking, no ranking is considered for that area as it would lack real or statistically-significant meaning. Therefore the following discussion considers only the areas of Ability to do Critical Analysis in Reading and Writing, and of Beliefs and Attitudes.

Reviewing first the results of the comparison of gains for the Test of Critical Analysis in Reading and Writing (Table XXVIII, Chapter IV), several interesting and provocative factors emerge. Superficially, after a preliminary examination of the test material, it might be expected that the results would be biased in favour of the Language and Literature group of students, since the materials upon which the test questions are based seem to bear the same cultural bias, i.e., Thoreau's Walden, the Rubaiyat, and the Sermon on the Mount.

However, the obtained results show that the greatest amount of change over a period of one academic year were achieved by the Home Economics group, the Agriculture and Forestry group, the Fine Arts group, and the Pre-Medical, Pre-Vet., Pre-Dental, and Nursing Education groups. The Language and Literature group ranked among the three groups showing the least amount of change, along with the Social Science and Social

Service group, and the Engineering group.

An examination of the raw scores of pre- and post-test results, (Table XXII, Chapter IV), shows much the same pattern of results. Obviously then, it becomes increasingly difficult to accept the concept of cultural bias in the test material. An explanation of the results must, then, rest on other possible factors such as motivation, pertinence of the Communication Skills course materials to the students' own areas of interest, the degree to which the ability being measured by this instrument is taught in other courses, and so forth.

Turning now, for the moment, to the results of the comparison of gains for the Inventory of Beliefs, similar interesting and yet provocative factors can be observed. In addition to its apparent ability to detect or measure change, because of the nature of its structure, the Inventory is designed to assist in the identification of students who tend to accept stereotypes, who are rather dependent and rigid in their attitudes and beliefs. However, it is a rather difficult task to discuss or to attempt to rationalize the relationship between these purposes of the test instrument and the obtained results. The greatest amounts of change over a period of one academic year were achieved by the Biological Science and Physical Science group, the Home Economics group, and the Social Science and Social Service group. The three groups showing the least amount of change were the Engineering group, the Elementary Education group, and the group composed of the Pre-Medical, pre-Veterinarian, pre-Dental, Nursing Education, and Medical Technician students.

It might be assumed that the students interested in the areas of

Biological Science and Physical Science could be expected to be imbued with what is often loosely referred to as the "scientific approach", and consequently could be expected to make the greatest change on a measure of belief and attitudes. Similarly, though possibly to a slightly less degree, this could also be expected of the type of student in the Social Science and Social Service group. Superficially, it would appear to be a slightly more difficult task to account for the high gain achieved on this measure by the students in the Home Economics category. However, a closer glance at the type of curriculum to which they have been exposed shows that to a very large extent it is one of considerable flexibility. Similarly, the subject matter of their course work, and indeed, of the Home Economics area as a whole, can be characterized by a noticeable lack of set standards and practices. Instead, there appears to be considerable latitude for personal taste and the exercise of individual judgment. Presumably then, students interested in this area could be expected to be of a type to which such a program would appeal, or in other words, of a type which could be expected to score high on this particular instrument.

It is also noteworthy that the assumption which might normally be made, that students in the Engineering group, like those in the Biological and Physical Science group, might also be expected to be imbued with the "scientific approach", and therefore could also be expected to show considerable gain in the areas of belief and attitude, does not appear to hold true in this case. As a matter of fact, the Engineering group is among the groups showing the least amount of gain in both the areas of Ability to do Critical Analysis in Reading and Writing and that of Beliefs and Attitudes.

Although, as has already been discussed, cultural bias of test material does not appear to have entered into the picture, it is nevertheless conceivable that the type of material which is used in the Test of Critical Analysis in Reading and Writing might have been sufficiently foreign to the students in the Engineering group as to nullify the validity of the instrument in this instance. But it is difficult to perceive how this argument can be applied to the Inventory of Beliefs.

An examination of the actual pre- and post-test raw scores discloses another interesting fact. In general, it would appear that those groups which scored lowest on the pre-test also scored lowest on the post-test administration, while the groups scoring highest on the pre-test also scored highest on the post-test administration.

It is also noteworthy that the "No-Preference" group which, theoretically at least, is composed of students who will eventually be found in every one of the other preference or interest areas, should rank just about the median on both instruments. This, of course, is what would normally be expected of this particular group. However, the fact that the statistical evaluation has borne out the logical expectation may be considered as additional evidence of the validity of the instruments when used for the purposes outlined in this study.

The Pike Study, carried out concurrently with this study, has discovered no differences in the areas of Critical Thinking, Ability to do Critical Analysis in Reading and Writing, and Beliefs and Attitudes, among groups of students when these groups are considered in relation to (a) the size of the high school they attended, (b) the size of the home community in which they grew up, (c) parents' occupation or income.

It would appear, therefore, that of the factors investigated in both these studies, only that of student interests or preferences would appear to have a significant relationship with change or achievement in the areas studied.

* * *

Implications for a Program of General Education

Having come this far in the discussion of the results of this research, the next point would seem to be that of the implications of these results for a program of general education, and more specifically, for the program of general education at Michigan State College.

The first, and most obvious fact, is that it would appear that means are now available to detect and to measure the impact of a general education program upon groups of students. Furthermore, within certain areas it would also appear to be possible to detect and measure differences in the amount of impact between various sub-groups.

However, the most intriguing and at the same time the most provocative implications appear to be those of the relationship of interest areas to gains or achievement in the areas of (a) Ability to do Critical Analysis in Reading and Writing, and (b) Level of Maturity of Beliefs and Attitudes.

If, as it would appear, interests or preferences do have a definite relationship to change in these areas, then certain modifications or alterations in the type of general education program offered to these students would presumably be in order.

There is no intention here of suggesting that a separate type of general education program be set up for each interest area as that would not only be impractical, but also not entirely in keeping with the underlying philosophy of the program. There are, however, certain suggestions which might be offered as recommendations for further consideration.

The first of these concerns the area of Ability to do Critical Analysis in Reading and Writing, i.e., the ability to read rather difficult materials thoughtfully and analytically, and to write clearly and effectively. The suggestion offered here is that greater attention be paid to the many varied student-interest areas in the selection and preparation of reading materials. This applies equally to both assigned and recommended materials. Undoubtedly it would be easier to effect this in the recommended readings than in the assigned readings. However, it is also a generally known and accepted fact that a large proportion of students do not do much more in the way of reading than is actually required of them, and so, many may never do more than glance at the list of readings.

It would therefore appear that a definite and concerted effort should be made by all departments within the Basic College, and not merely by the department of Communication Skills, to provide a sufficiently wide variety of material within their own subject-areas to appeal to students in all of the interest categories. Furthermore, all departments should make every possible effort to ascertain the interests of their students and to select readings that most closely match these interests.

Encouragement should also be offered the individual to select his own materials, provided of course that they apply to the general area under consideration. It should be emphasized again that this ought not to be considered the sole concern of the department of Communication Skills, but must be considered as being a concern of all instructional areas and all departments.

This concept of a common concern or responsibility shared by all departments applies as well to the area of Beliefs and Attitudes. In general, students scoring low in this area on the Inventory of Beliefs are those who tend to be rather rigid and immature in their beliefs and attitudes, who tend to accept and cling to stereotypes. Some evidence has been collected by the Cooperative Study (527:18-19), which would indicate that low scorers on the Inventory do not seem to achieve as well, especially in areas in which there are relatively few fixed standards such as the Social Sciences, Humanities, and Art and Literature, as do the higher scorers.

In addition to this concern with specific academic or curriculum objectives, there is, of course, the underlying objective of the entire general education program of developing the mature, independent, reality-minded, flexible and adaptive individual upon whom the future progress of a democratic society depends.

Therefore, it becomes the concern of all departments to assist in achieving this objective in all possible ways. One approach might be for each department to review its offerings with the purpose of providing the maximum number of experiences within its own area that might assist students in overcoming any tendency towards rigidity and stereotyping.

Furthermore, each department, and indeed, each instructor, should make an effort to determine just where its students stand in relation to these facets of personality. Working from this basis, and with a knowledge of the difficulties of this nature embodied in their own curricula, they could then make an effective attempt at assisting the student to work toward the successful achievement of the goals of general education.

Finally, since the factor of student interest, or preference, has shown itself to be of significant importance, more concern ought to be given it in the development of the general education curriculum as a whole. Some possible ways in which this might be accomplished are as follows:-

- A. A broader system of free electives during the Freshman and Sophomore years.
- B. A well-designed and successfully-operating program of acceleration whose ultimate aim would not only be viewed as a means of permitting students to enter their chosen field of specialization more quickly, - but would be viewed as providing a means and an opportunity of encouraging students to become more versatile, and to do more advanced work within the area of their proficiency.
- C. More careful attention to the way in which class-sections are organized and set up. Providing separate sections for students of common interests and objectives might enable both students and instructors to discuss problems and course material in terms of mutual interests and experiential back-

ground, and with a common semantic orientation.

- D. More careful attention to the way in which classes are conducted. The instructor should make a definite attempt to ascertain the general as well as the specific interests of his students, and should then attempt, insofar as possible, to conduct his classes with these in mind.

These, then, are the results of this study, and the implications of these results as the writer sees them. In presenting this, a special attempt has been made to do so in a manner which would not only be objective and scientific, but which would also have the greatest relevance to the ongoing program of general education at Michigan State College.

* * *

APPENDIX

APPENDIX TABLE I

COMPUTATION OF CHI-SQUARE TEST OF REPRESENTATIVENESS BETWEEN FINAL WORKING SAMPLE (N = 596), AND REMAINDER OF FRESHMEN TESTED (N = 1046)

Derived Scores (ACE "Totals")	Remainder of Freshmen Tested a'	Final Working Sample a	a + a'	P = $\frac{a}{a+a'}$	aP
0	2	1	3	.33333	.33333
9	25	11	36	.30556	3.36116
8	76	31	107	.28972	8.98132
7	154	62	216	.28704	17.79648
6	247	179	426	.42019	75.21401
5	228	133	361	.36842	48.9986
4	180	104	284	.3620	38.08480
3	87	51	138	.36957	18.84807
2	39	22	61	.36066	7.93452
1	8	2	10	.20000	.40000
	1046 n ₂	596 n ₁	1642	$\bar{P}$	219.95355 $\Sigma (aP)$

$$\bar{P} = \frac{n_1}{n_1+n_2} = \frac{596}{1642} = .36297; \quad \bar{q} = .63703$$

$$\chi^2 = \frac{1}{\bar{P}\bar{q}} [\Sigma(aP) - (n_1\bar{P})] = \frac{1}{(.36297)(.63703)} [219.95355 - (596)(.36297)]$$

$$= \frac{1}{.23122} [219.95355 - 216.33012] = (4.32489)(3.62343)$$

$$= 15.67094; \text{ with } 9^{\circ} \text{ freedom } < 16.919 \text{ at } .05; \text{ or } 21.666 \text{ at } .01.$$

There is, therefore, no significant difference at either the 1% or the 5% levels of confidence between the final working sample and the remainder of the Freshmen tested by the Cooperative Study.

APPENDIX TABLE II

COMPUTATION OF CHI-SQUARE TEST OF REPRESENTATIVENESS BETWEEN FINAL WORKING SAMPLE (N=596), AND ORIGINAL "FALL TERM" WORKING SAMPLE (N=896)

Derived Scores (ACE "Totals")	Original "Fall" Term" Sample a'	Final Working a	a + a'	P = $\frac{a}{a+a'}$	aP
0	8	1	9	.11111	.11111
9	25	11	36	.30556	3.36116
8	51	31	82	.37805	11.71955
7	116	62	178	.34831	21.59522
6	240	179	419	.42721	76.47059
5	206	133	339	.39233	82.17989
4	135	104	239	.43515	41.09077
3	74	51	125	.40800	20.30800
2	33	22	55	.40000	8.80000
1	8	2	10	.20000	.40000
	896 n ₂	596 n ₁	1492	$\bar{P}$	241.13627 $\Sigma(aP)$

$$\bar{P} = \frac{n_1}{n_1+n_2} = \frac{596}{896+596} = \frac{596}{1492} = .39946; \quad \bar{q} = .60054$$

$$\begin{aligned} \chi^2 &= \frac{1}{\bar{P}\bar{q}} \left[\Sigma(aP) - (n_1\bar{P}) \right]^2 = \frac{1}{(.39946)(.60054)} \left[241.13627 - (596)(.39946) \right]^2 \\ &= \frac{1}{.23989} \left[241.13627 - 238.07816 \right]^2 = (4.16858)(3.05811) \\ &= 12.74798; \text{ with } 9^\circ \text{ freedom } < 16.919 \text{ at } .05; \text{ or } 21.666 \text{ at } .01. \end{aligned}$$

There is, therefore, no significant difference at either the 1% or the 5% levels of confidence between the final working sample and the Original "Fall Term" working sample.

APPENDIX TABLE III

COMPUTATION OF CHI-SQUARE TEST OF REPRESENTATIVENESS BETWEEN FINAL WORKING SAMPLE FOR CRITICAL THINKING TEST - FORM A (N=302), AND FINAL WORKING SAMPLE FOR CRITICAL THINKING TEST-FORM B (N=294).

Derived Scores (ACE "Totals")	Final Working Sample Form A a'	Final Work- ing Sample Form B -a'	a+a'	P = $\frac{a}{a+a'}$	aP
0	1	0	1	.00000	.00000
9	8	3	11	.27273	.81819
8	17	14	31	.45161	6.32254
7	29	33	62	.53226	17.56458
6	96	83	179	.46369	38.48627
5	65	68	133	.51128	34.76704
4	51	53	104	.50962	27.00986
3	24	27	51	.52941	14.29407
2	11	11	22	.50000	5.50000
1	0	2	2	1.00000	2.00000
	302 n ₂	294 n ₁	596 -	.49329 P	146.76255 ΣaP

$$\bar{P} = \frac{n_1}{n_1 + n_2} = \frac{294}{596} = .49329$$

$$\bar{q} = .50671$$

$$\chi^2 = \frac{1}{\bar{P} \bar{q}} [\Sigma(aP) - (n_1 \bar{P})] = \frac{1}{.49329 \times .50671} [146.76255 - (294)(.49329)]$$

$$= \frac{1}{.24995} [146.76255 - 145.02726]$$

$$= 4.00080 \times 1.73526$$

$$= 6.94243; \text{ with } 9^{\circ} \text{ freedom } < 16.919 \text{ at } .05; \text{ or } 21.666 \text{ at } .01.$$

There is, therefore, no significant difference at either the 1% or the 5% levels of confidence between the final working sample for the Critical Thinking Test - Form A, and the final working sample for the Critical Thinking Test - Form B.

SAMPLE OF INSTRUCTION SHEETS GIVEN TO
INSTRUCTORS IN THE DEPARTMENT OF COMMUNICATION SKILLS
PRIOR TO THE ADMINISTRATION OF THE POST-TESTING PROGRAM

Sections 2R Instructions KENNEDY

IMPORTANT

In addition to this packet of material, be sure you pick up the following number of test booklets from the office:-

You need 13 copies of Form A, Test of Critical Thinking Booklets
You need 13 copies of Form B, Test of Critical Thinking Booklets
You need 26 copies of the Inventory of Beliefs.
You need 26 I B.M. pencils.

* * * * *

This packet includes:

1. Instructions for Test Administration.
2. Your class roll, indicating which form of the Critical Thinking Test, (Form A or B), each member of your class is to take.
3. Sufficient answer sheets for the administration of the two tests. (The same type of answer sheet is used for both tests)
4. Sufficient copies of the questionnaire to be given to all pupils.
5. Scratch paper to be used by the pupils if it is needed.

Cooperative Study of Evaluation in Schools
of the
American Council on Education

INSTRUCTIONS FOR ADMINISTERING TESTS

1. a) Administer the short questionnaire. This should be done at the beginning of the class.
b) Collect the completed questionnaires.
2. a) Distribute the answer sheets, and Form A or B of the Critical Thinking Test according to the teacher class roster.
b) Note: It is most important that each student receive the correct form of the Critical Thinking Test, as indicated on the class roster.
c) Be sure that each student writes his name, first and last name, on the Form of the Test, (A or B), on the answer sheet.
d) Ask the students to read the instructions printed on the test booklet.
e) Allow about 45 minutes for this test.
f) Collect the test booklets and the answer sheets.
3. a) Distribute the answer sheets and the Instrument of Beliefs Test.
b) Remind the students to write their names, first and last name, (Instrument of Beliefs), on the answer sheets.
c) Ask the students to read the instructions printed on the Instrument of Beliefs Test.
d) Allow about 45 minutes for this test.
e) Collect the test booklets and the answer sheets.
4. a) Please return test booklets to their proper piles in the back of the room.
b) Please place the completed answer sheets in the boxes provided for this purpose.
5. Your cooperation in carrying out this testing program is greatly appreciated, and we shall be glad to meet with you at a later date to explain and discuss the results that are obtained.

SAMPLE OF CLASS LIST GIVEN TO INSTRUCTORS IN THE
DEPARTMENT OF COMMUNICATION SKILLS PRIOR TO THE ADMINISTRATION
OF THE POST-TESTING PROGRAM

REGISTRAR

EXPLANATION OF CODES OF CURRICULUM

1 - BASIC COLLEGE

- No Maj.
- 10-Agriculture
- 11-Commerce
- 20-B. & P. S. No Maj.
- 21-Med. Rest & G. M.
- 22-Journalism
- 23-Phys. Educ.
- 24-Health & Soc.
- 25-Public Admin.
- 26-Social Sci.
- 27-Economics
- 28-Eng. & Arch.
- 30-Engineering
- 31-Home Economics
- 32-Ind. Arts
- 33-Phys. Educ.
- 34-Languages & Lit.
- 35-Nursing Educ.
- 36-Bus. Admin.

2 - SCHOOL

Class	Section	X-List, L-List, R-List
1-Freshman	2-Sophomore	3-Junior
4-Senior	5-Special	6-Graduate

INSTRUCTOR'S NAME

NO.	NAME	CURR.	CL.	STUDENT NUMBER	DEPT.	COURSE NUMBER	SECTION	CREDITS	Y
1	BRIGHTON CHARLES A	352	CLV	1090801	WSE	113	2-1	3	
2	BROCK WILLIAM ROSS	1		1076601	WSE	113	2-1	3	
3	CARRIGAN DAVID EUGENE	162		1076735	WSE	113	2-1	3	
4	CARROLL EDWARD B	157		1079409	WSE	113	2-1	3	
5	COUMA JAMES LEE	130		1077125	WSE	113	2-1	3	
6	DAVNEY HELEN LOUISE	1		1076739	WSE	113	2-1	3	
7	HART EARL BENJAMIN	121		1079543	WSE	113	2-1	3	
8	HOFFMEYER NEIL T	1		1079629	WSE	113	2-1	3	
9	JOOP MARGARET ANN	126		1076643	WSE	113	2-1	3	
10	KELLEY ASA ELWYN	152		1076635	WSE	113	2-1	3	
11	KENNERY MARJORIE J	153		1079014	WSE	113	2-1	3	
12	KURTZ JOHN STEVEN	1		1076626	WSE	113	2-1	3	
13	LATRO THOMAS F	120		1076725	WSE	113	2-1	3	
14	LONG RICHARD ARTHUR	156		1076779	WSE	113	2-1	3	
15	LOWERY FRUDY	140		1079561	WSE	113	2-1	3	
16	MARTIN ROBERT DALE	162		1077568	WSE	113	2-1	3	
17	MCCAFFERY SUSAN ANN	1		1076629	WSE	113	2-1	3	
18	OLIVER M CHRISTINE	150		1077671	WSE	113	2-1	3	
19	RIECKELMAN JOAN A	140		1079091	WSE	113	2-1	3	
20	SACKMAN MERLE K	124		1078069	WSE	113	2-1	3	
21	SMITH DONALD LEE	130		1078117	WSE	113	2-1	3	
22	UZELAG WILLIAM EDW	1805		1079809	WSE	113	2-1	3	
23	WATER PATRICIA ANN	155		1076775	WSE	113	2-1	3	
24	WEAVER ANN MERLE	1		1077639	WSE	113	2-1	3	
25	YATES WILLIAM J	1		1076522	WSE	113	2-1	3	
26	ZICK WILLIAM CHAS	159		1080241	WSE	113	2-1	3	
27	780	026		0139					
28									
29									
30									
31									
32									
33									
34									
35									
36									

This list constitutes official enrollment in the course and section listed for the students whose names are on it. Students whose names are not on the list should be excluded from the class and sent to the Registrar's Office. Students on this list who do not come to class should be reported as having excessive absences. Changes on this list should be made only when: (1) Official copy of test cards are received; (2) students are changed from one section to another within a course and the change reported to the Registrar's Office.

Note: Students ordered to attend work before their names are given Form A of the Critical Thinking Test.

All students are to be on the list of the Inst.

SAMPLE OF THE SHORT SUPPLEMENTARY QUESTIONNAIRE
GIVEN TO ALL STUDENTS AT THE TIME OF THE
POST-TESTING PROGRAM

2339

Cooperative Study of Evaluation in General Education
of the
American Council on Education.

QUESTIONNAIRE

1. NAME Lutz, Sally Jean
Last First Middle
2. Student number 79126
3. What is your major? Piano PSM
4. Have you changed majors during the year? Yes
Yes No
5. If you have made a change of major, please indicate what this change was, and when you made it.

- 99
SD-1
1. from No Pref to Music : now Fall Winter Spring Summer X
2. from _____ to _____ : now Fall Winter Spring Summer

6. What was the approximate size of your high school?

Class "A" (100 pupils and up) _____

Class "B" (500 to 799) 700

Class "C" (750 to 999) _____

Class "D" (up to 1200) _____

W

SAMPLE OF THE PREPARED DATA-SHEET ON
WHICH THE DATA WERE COLLECTED AND CODED

(Pre-Test Data are Coded in Red; Post-Test Data are Coded in Blue)

NAME: Smith, Mary A.

ITEM	DATA	CODE	COLUMN
Case Number	13	0013	1 - 4
Age	18	2	5
Sex	F	2	6
Community	3	3	7
Father's Occupation	Physician	0	8
Class	F	1	9
Winter term preference (Not used except as reference)		23	10
XXXX			11
XXXXXXXXXXXX (Not used)		00	12 - 13
XXXXXXXXXXXX (Not used)		20	14 - 15
XXXXXXXXXXXX Used for Pike Study			16 - 17 - 18
A.C.E. Raw Score, Total	101	101	19 - 20 - 21
AC.E. Sub-score, "L"	67	067	22 - 23 - 24
A.C.E. Sub-score, "Q"	34	034	25
A.C.E. Total (Decile)	5	5	26
A.C.E. "L" (Decile)	6	6	27
A.C.E. "Q" (Decile)	4	4	28 - 29
C.T., Initial	42	42	30 - 31
C.T., Post-test	40	40	32 - 33 - 34
C.T., Change (Year)	-02	202	35 - 36
Fall Term Preference		23	37 - 38 - 39
XXXXXXXXXXXX (Not used)		235	40 - 41 - 42
Spring Term Preference			43 - 44 - 45
XXXXXXXXXXXX (Not used)			46 - 47 - 48
I. of B., Initial	64	064	49 - 50 - 51
I. of B., Post-test	59	059	52 - 53 - 54
I. of B., Change (Year)	-05	205	55 - 56
XXXXXXXXXXXX (Not used)		000	57 - 58
XXXXXXXXXXXX (Not used)		000	59 - 60 - 61
C.A.R.M. Initial	16	16	62
Post-test	20	20	
C.A.R.M. (Not used)		104	
C.A.R.M. Change			
New grouped preferences			

SAMPLE OF CODED AND PUNCHED I.B.M CARD

TABLE IV

Post-Test Item Analysis Data for Critical Thinking, Form A

(Tests Administered to Michigan State College Freshmen in Early June, 1952)

<u>No.</u>	<u>Disc.</u>	<u>Diff.</u>	<u>No.</u>	<u>Disc.</u>	<u>Diff.</u>
1	.54	78	30	.43	90
2	.55	89	31	.25	42
3	.47	74	32	.15	63
4	.35	95	33	.44	59
5	.53	90	34	.37	50
6	.53	90	35	.12	69
7	.45	89	36	.53	67
8	.55	89	37	.51	86
9	.44	80	38	.26	36
10	.25	67	39	.36	88
11	.32	76	40	.26	88
12	.26	26	41.	.49	81
13	.41	63	42	.42	85
14	.33	65	43	.61	61
15	.26	79	44	.20	48
16	.02	41	45	.26	88
17	.40	91	46	.66	60
18	.80	66	47	.39	67
19	.55	89	48	.38	87
20	.23	59	49	.24	70
21	.43	67	50	.25	67
22	.33	30	51	.22	64
23	.43	45	52	.39	47
24	.27	41	53	.24	63
25	.03	25	54	.38	87
26	.36	23	55	.61	73
27	.40	52	56	.63	84
28	.27	71	57	.58	75
29	.16	67			

TABLE V

Post-Test Item Analysis Data for Test of Critical Analysis in Reading
and Writing

(Tests administered to Michigan State College Freshmen in Early June, 1952)

<u>No.</u>	<u>Disc.</u>	<u>Diff.</u>	<u>No.</u>	<u>Disc.</u>	<u>Diff.</u>
1	.42	60	21	.47	74
2	.41	63	22	.41	37
3	.21	40	23	.40	30
4	.35	45	24	.59	20
5	.36	77	25	.21	42
6	.25	54	26	.42	53
7	.15	28	27	.12	80
8	.22	34	28	.25	33
9	.36	71	29	.51	14
10	.36	34	30	.45	75
11	.29	46	31	.15	35
12	.31	55	32	.35	49
13	.25	16	33	.08	52
14	.44	76	34	.20	45
15	.50	31	35	.51	55
16	.12	64	36	.56	28
17	.29	35	37	.63	22
18	.32	59	38	.40	59
19	.57	29	39	.44	52
20	.30	83	40	.26	36

TABLE VI

Post-Test Item Analysis Data for Inventory of Bdiefs

(Tests Administered to Michigan State College Freshmen in early June, 1952)

<u>No.</u>	<u>Disc.</u>	<u>Diff.</u>	<u>No.</u>	<u>Disc.</u>	<u>Diff.</u>	<u>No.</u>	<u>Disc.</u>	<u>Diff.</u>
1	.31	43	41	.25	23	81	.42	81
2	.33	11	42	.33	85	82	.50	76
3	.10	61	43	.34	75	83	.30	23
4	.43	62	44	.29	87	84	.47	74
5	.31	51	45	.28	39	85	.54	47
6	.34	78	46	.35	51	86	.47	65
7	.37	68	47	.31	70	87	.20	67
8	.15	87	48	.35	47	88	.35	43
9	.28	27	49	.15	35	89	.30	90
10	.23	55	50	.38	17	90	.42	60
11	.27	34	51	.41	71	91	.39	55
12	.16	83	52	.07	69	92	.58	25
13	.42	19	53	.27	24	93	.48	64
14	.09	89	54	.35	57	94	.39	57
15	.21	56	55	.17	36	95	.24	65
16	.43	73	56	.49	34	96	.25	54
17	.24	75	57	.37	80	97	.31	29
18	.39	55	58	.38	83	98	.34	38
19	.24	33	59	.37	92	99	.26	82
20	.23	39	60	.55	31	100	.48	77
21	.12	54	61	.31	26	101	.48	82
22	.38	60	62	.52	36	102	.46	68
23	.51	80	63	.45	56	103	.38	70
24	.28	78	64	.39	67	104	.42	51
25	.60	54	65	.55	16	105	.43	67
26	.38	76	66	.56	48	106	.44	76
27	.17	56	67	.37	46	107	.12	46
28	.37	80	68	.09	90	108	.45	46
29	.45	63	69	.26	40	109	.26	79
30	.42	35	70	.56	54	110	.43	67
31	.47	43	71	.39	33	111	.40	18
32	.25	44	72	.35	49	112	.12	18
33	.13	58	73	.28	73	113	.36	66
34	.27	34	74	.36	39	114	.51	62
35	.17	64	75	.40	50	115	.23	8
36	.10	47	76	.41	44	116	.41	26
37	.36	66	77	.34	75	117	.41	71
38	.28	39	78	.26	18	118	18	25
39	.30	28	79	.34	67	119	.49	19
40	.37	46	80	.41	74	120	.47	43

Scoring Key for the Test of Critical Thinking, Form A

<u>Item</u>	<u>Answer</u>	<u>Item</u>	<u>Answer</u>
1	1	30	5
2	3	31	2
3	2	32	4
4	1	33	3
5	1	34	2
6	2	35	1
7	3	36	2
8	2	37	4
9	1	38	2
10	4	39	3
11	4	40	3
12	2	41	1
13	5	42	4
14	2	43	2
15	1	44	2
16	2	45	4
17	3	46	2
18	3	47	4
19	2	48	2
20	3	49	3
21	1	50	3
22	1	51	4
23	5	52	2
24	2	53	1
25	2	54	4
26	1	55	4
27	1	56	2
28	1	57	4
29	1		

Scoring Key for the Test of Critical Analysis in Reading and Writing

<u>Item</u>		<u>Item</u>	
1	3	26	2
2	2	27	3
3	2	28	2
4	3	29	4
5	2	30	1
6	3	31	4
7	2	32	3
8	1	33	3
9	3	34	1
10	1	35	2
11	1	36	3
12	2	37	1
13	2	38	2
14	1	39	2
15	1	40	1
16	2	41	3
17	2	42	4
18	3	43	4
19	1	44	3
20	4	45	4
21	3	46	3
22	2	47	3
23	2	48	1
24	2	49	2
25	1	50	2

SCORING KEY FOR INVENTORY OF BELIEFS

The test is scored by giving one point for each "disagree" or "strongly disagree" response. The total score is the total number of such responses.

TABLE VII

SUMS OF X ; SUMS OF X^2 ; AND CROSS PRODUCTS
FOR THE TEST OF CRITICAL ANALYSIS IN READING AND WRITING AND FOR THE A.C.E. PSYCHOLOGICAL EXAMINATION

Code N	$CA_1 \times CA_2$	$CA_1 \times$ Total Psych.	$CA_2 \times$ Total Psych.	ACE Psychological "Total Score"		C.A.R.W. Pre-Test (CA ₁)		C.A.R.W. Post-Test (CA ₂)	
				Sums of X	Sums of X^2	Sums of X	Sums of X^2	Sums of X	Sums of X^2
*12	27	7 652	41 934	53 156	301 201	402	6 178	514	10 050
11	17	6 043	30 798	39 265	210 600	274	4 804	349	7 795
0	46	12 629	68 019	92 373	508 275	645	9 679	875	17 569
1	40	10 717	57 779	75 943	422 879	561	8 455	737	14 375
2	96	24 861	144 104	169 858	1 019 250	1 387	22 099	1 634	29 864
3	60	16 580	99 755	126 068	765 178	876	13 646	1 036	20 256
4	47	13 010	69 306	96 568	515 212	662	9 788	1 010	20 844
5	16	3 815	23 059	29 104	169 026	224	3 246	277	4 987
6	41	11 949	67 066	75 870	439 355	644	10 920	731	13 981
7	23	7 369	40 528	48 552	271 910	368	6 418	443	8 929
8	22	5 397	32 634	40 497	260 766	307	4 565	376	6 784
9	161	44 065	244 314	310 404	1 765 876	2 310	36 538	2 948	58 092
TOTALS	164 087	919 296	1 157 658	61 946	6 650 528	8 660	136 336	10 930	213 526
*Less									
No.12	7 652	41 934	53 156	2 847	301 201	402	6 178	514	10 050
Totals									
Used	156 435	877 362	1 104 502	59 099	6 349 327	8 258	130 158	10 416	203 476

*Data for this group not used in calculations for Test of Critical Analysis in Reading and Writing (See Chapter IV).

TABLE IX

SUMS OF X; SUMS OF X^2 ; AND CROSS PRODUCTS
FOR THE INVENTORY OF BELIEFS AND FOR THE A.C.E. PSYCHOLOGICAL EXAMINATION

Code	N	$IB_1 \times IB_2$	$IB_1 \times \text{Total Psych.}$	$IB_2 \times \text{Total Psych.}$	ACE Psychological "Total Score"		I. of B. Pre-Test (IB_1)		I. of B. Post-Test (IB_2)	
					Sums of X	Sums of X^2	Sums of X	Sums of X^2	Sums of X	Sums of X^2
*12	27	121 424	178 364	196 745	2 847	301 201	1 729	110 911	1 917	135 979
11	17	80 172	116 723	141 775	1 878	210 600	1 045	66 947	1 273	98 023
0	46	164 057	273 225	290 032	4 779	508 275	2 618	156 852	2 778	177 338
1	40	148 678	232 885	261 165	4 051	422 879	2 263	133 365	2 540	169 020
2	96	328 509	541 266	598 086	9 712	1 019 250	5 247	305 045	5 792	368 640
3	60	238 948	392 345	440 472	6 694	765 178	3 286	202 060	3 670	252 792
4	47	171 934	273 808	309 391	4 858	515 212	2 871	167 965	3 245	214 589
5	16	62 575	95 925	108 297	1 564	169 026	933	58 599	1 046	71 206
6	41	140 890	233 939	251 763	4 203	439 355	2 280	131 650	2 464	154 170
7	23	90 210	148 310	160 181	2 476	271 910	1 374	84 190	1 483	98 135
8	22	79 102	124 106	153 988	2 416	260 766	1 173	66 487	1 453	99 011
9	161	603 568	929 728	1 063 099	16 468	1 766 876	9 032	537 967	10 334	697 706
TOTALS		2 230 067	3540 624	3 974 994	61 946	6 650 528	33 852	2 022 118	37 995	2 536 609
*Less										
No.12		121 424	178 364	196 745	2 847	301 201	1 729	110 911	1 917	135 979
Totals										
Used		2 108 643	3362 260	3 778 249	59 099	6 349 327	32 123	1 911 207	36 078	2 400 630

*Data for this group not used in calculations for Inventory of Beliefs (See Chapter IV).

Cooperative Study of Evaluation in General Education
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A TEST OF CRITICAL THINKING

FORM A

Read these directions before beginning the test.

Improvement of your ability to think critically and effectively is one of the aims of general education. This test is designed to provide a measure of your competence in dealing with a variety of problems, all of which require some kind of critical thinking. The test does not cover all aspects of critical thinking, but it does involve several important types of thinking.

Within the test you will find directions for groups of questions. Read these directions carefully so that, before you answer a question, you know just what is being asked.

You are expected to complete the test within 45 minutes.

Your score will be the number of questions you answer correctly.

You may, in some cases, come across words which are not familiar to you. If you do, don't worry about it. The unfamiliarity of such words will not prevent your answering the questions.

Your answers to the questions are to be recorded on a separate answer sheet. Fill in the blank spaces on the side of your answer sheet (your name, the date, etc.). For Name of Test, write Critical Thinking. For Part, write Form A.

Mark only the ONE BEST ANSWER to each question.

Do not make any marks on this test booklet. Use scratch paper if necessary.

Items 1 through 9 refer to the following story and conclusion:

In a radio broadcast the following story was told: "The people in a little mining town in Pennsylvania get all their water without purification from a clear, swift-running mountain stream. In a cabin on the bank of the stream about half a mile above the town a worker was very sick with typhoid fever during the first part of December. During his illness his waste materials were thrown on the snow. About the middle of March the snow melted rapidly and ran into the stream. Approximately two weeks later typhoid fever broke out in the town. Many of the people became sick and 114 died."

Conclusion: The speaker then said that this story showed how the sickness of this man caused wide-spread illness and the death of over one hundred people.

Items 1 through 9 are statements which might appear in a discussion of this conclusion. Assuming that the story as told was true, mark each statement according to the following scale:

1. The statement argues for the conclusion.
 2. The statement argues against the conclusion.
 3. The statement argues neither for nor against the conclusion.
1. Typhoid fever organisms have been known to survive for several months at temperatures near the freezing point.
 2. Good doctors should be available when an epidemic hits a small town.
 3. There may have been other sources of contamination along the stream.
 4. The waste materials of a person who has a severe case of typhoid fever contain active typhoid organisms.
 5. Typhoid fever may be contracted by using water which contains typhoid germs.
 6. Typhoid organisms are usually killed if subjected to temperatures near the freezing point for a period of several months.
 7. Sickness and death usually result in a great economic loss to a small town.
 8. There may have been other sources of typhoid fever germs in the town, such as milk or food contaminated by some other person.
 9. The symptoms of typhoid fever usually appear about two weeks after contact with typhoid germs.

* * * * *

Select the one best answer to each of the following items (10-13).

10. "There are women Eskimos. How do I know? Because everyone knows some men are not adult Eskimos, and this means some adult Eskimos are not men. That's how I know there are women Eskimos." This argument is
 1. acceptable reasoning, because the conclusion is true.
 2. faulty reasoning, because it is not true that "if they're not men they would have to be women."
 3. acceptable reasoning, because "some men are not adult Eskimos" does mean "some adult Eskimos are not men" and it is true that if they're not men they would have to be women.
 4. faulty reasoning, because we can believe "some men are not adult Eskimos" without believing also that "some adult Eskimos are not men."
 5. acceptable reasoning, because the conclusion, regardless of its truth, certainly follows from the reasons given.
11. A stock breeder plans to ship 50 horses, 50 cows, 50 goats, 50 sheep, and 50 pigs to a new location. In order to make a fairly accurate estimate of the total weight of his animals, which of the following would be most useful to him?
 1. The total weight of 50 animals from his stock, selected at random.
 2. The average weight of 50 animals from his stock, selected at random.
 3. The total weight of one horse, one goat, one cow, one pig, and one sheep, each selected at random.
 4. The combined average weights of 5 pigs, 5 sheep, 5 goats, 5 horses, and 5 cows, all selected at random.
 5. The average weight of the first 125 animals to enter the barn.
12. The head physician at Cowlick College wishes a reasonably accurate estimate of the number of cases of chicken pox treated at the infirmary during the past five years, but his time is limited. A total of 10,000 cases of all kinds of sickness were treated during the period. A study of which of the following samples from his records would probably be adequate and still conserve his time?
 1. Every odd-numbered case from the 10,000.
 2. Every twentieth case from the 10,000.
 3. 400 cases selected to represent proportionately each age group.
 4. The last 400 cases treated.
 5. The last 200 cases treated.
13. Which of the samples in Item 12 would probably be the LEAST accurate?

* * * * *

In Items 14 through 17 you are to accept as true that all window-washers are poorly paid, and some window-washers have large families. Mark each of the conclusions, 14 through 17 according to the following scale:

1. Must be true on the basis of the given statements.
 2. Might be true on the basis of the given statements.
 3. Must be false on the basis of the given statements.
14. Some people who have large families are not poorly paid.
15. Some people who are poorly paid have large families.
16. All people who are poorly paid have large families.
17. No people who are poorly paid have large families.

* * * * *

At a faculty conference Professor Chatterry said:
NO EDUCATED MAN IS UNPREPARED FOR MARRIAGE.

Other faculty members commented on this remark, and their comments are given in Items 18 through 21. Mark each of these comments according to the following scale:

1. That means just the same thing Chatterry said.
 2. No. That can't be true if Chatterry is right.
 3. You can't tell from what Chatterry said whether that is true or not.
18. Everyone who is prepared for marriage is educated.
19. Some men who are unprepared for marriage are educated.
20. If a man is not educated, he is prepared for marriage.
21. No one who is unprepared for marriage is an educated man.

* * * * *

Items 22 through 27 refer to the following argument:

The college committee in charge of social regulations was holding an open hearing on a proposal that the rule on chaperoning coeducational outings (wiener roasts, overnight hikes, campfires, etc.) should be more strictly applied. A student in the audience got the floor and made this speech:

- A. This whole discussion is ridiculous, for we shouldn't have chaperones at all!
- B. You see, any chaperone you get will either arrange not to see what happens or he will be so badly outnumbered he can't keep track of what is going on.
- C. But chaperones are supposed to guarantee that what goes on is respectable.

- D. So the chaperone system is utterly ineffective and full of hypocrisy.
- E. Besides, collegians will never develop maturity unless they are given responsibilities to exercise and are really trusted with these responsibilities.

22. There is one statement which the student did not offer as a reason for any other statement. That statement, his main conclusion, is

1. A
2. B
3. C
4. D
5. E

23. The student A as a reason for

1. B
2. C
3. D
4. E
5. none of these.

24. The student offered B as a reason for

1. C
2. D
3. C and D
4. E
5. none of these.

25. The student offered C as a reason for

1. B
2. D
3. E
4. D and E
5. none of these.

26. The student offered D as a reason for

1. A
2. B
3. C
4. E
5. none of these.

27. The student offered E as a reason for

1. A
2. B
3. C
4. D
5. none of these.

* * * * *

Items 28 through 33 concern definitions of problems. Each item is a brief description of a situation, followed by five possible statements of the problem involved. Select from the five statements the one which

- a. faces the problem, and
- b. is broadest and most inclusive.

The statement you select need not be the wisest one or the one you would personally accept. You are to select only on the basis of whether the statement faces the problem and is broad and more inclusive than the other statements.

28. The Kemp family wishes to repaint its living room walls. Their problem is:

1. What color and kind of paint will best fit the family's use of the room and budget of time and money.
2. What color goes best with the rugs and curtains.
3. How best to time the painting in relation to baby's sleep, Jane's birthday party, and other events scheduled for the house.
4. What kind of paint--water or oil base, etc.--is cheaper in the long run, immediate area covered and washability and durability all considered.
5. Whether they should use wallpaper since it will be cheaper and more colorful.

29. A recently married couple decide that they will give \$200 of their annual income to charity. Their problem is:

1. What charity-supported works are most deserving and in need of the money they can give, and what distribution of their \$200 best balances these demands?
2. How to deal with those making the appeals, with the least time and bother and with the most congenial response to their requests.
3. Which of the appeals which come to them is most worthy?
4. Whether this amount (\$200) is too much or too little for the cause they want to aid.
5. Whether concentration of their gifts in one agency would do more ultimate good than distribution of it among several users.

30. A housewife is trying to decide upon a menu for a dinner for eight. Her problem is what choice of foods would be most

1. indicative of a cultured, hospitable, and moderately well-off family.
2. economical to prepare and, in view of their different needs, healthful for all of her guests.
3. likely to conserve time, energy, and expense in preparation and serving.
4. novel and interesting as works of culinary art, and sure to keep conversation going if no other topics catch on.
5. satisfying to the tastes and needs of the group and of the occasion and within her budget.

31. A college junior, Howard is enrolled in English History. In the mid-semester test he found that he was near the low end of the grade curve, chiefly because a large number of students had used "ponies" on the test. Howard told the professor about the cheating, but this professor could not believe that cheating could occur in his classes without his observing it. Howard must receive a high grade in this course if he is to maintain his membership in the college honor society. Howard's problem is:

1. Should he give up getting into the honor society in favor of concentrating on other benefits in English History?
2. How could he do something effective to improve the conduct of examinations at his college while getting the best honest grade possible?
3. How could he get a good grade in the course even though his examination grade was low?
4. Considering not only "ponies" and other means of improving his own grade, but also ways to confuse or otherwise trap his cheating competitors into showing their hand, how could Howard compete with them?
5. How could he get the professor to see the real situation and lead an effort to correct it?

32. A shy but talented freshman, who has had little experience in dating, telephones a popular and considerate upperclass woman for a date to the main dance of the year just two days before the big event. Which of the following answers shows the best perception of the problem she is dealing with?

1. "Sorry! I'm all dated up. I didn't think you would ask me."
2. "I'd love to, Doug, but I have a date already. Give me a chance again next year, will you?"
3. "Thanks, Doug, but Jack got here first. I can get you a date though, and a bid to a gay old party afterwards where you can really let your hair down. Are you game?"
4. "Gee, I've already accepted Jack's bid. But, say, would you like a tip on a cute girl who's holding out another day on a bid she's got in hopes you'd call?"
5. "Sorry, Doug. Have you tried calling any of the freshman girls?"

33. "Where are you going to settle?" one graduate asked another. Which of the following responses shows the best perception of the problem?

1. "Albany. That's where my best job offer is."
2. "We're not going to settle right away. First we'll see a bit of the world and then maybe look for a job."
3. "Somewhere in the Southwest. We prefer the country and people, and the wife's asthma isn't so bad there."
4. "I can make a living anywhere, so we'll probably live near Washington, D.C. It's interesting to be near the center of political activities."
5. "Millie likes the mountains, and I like the seashore; the best jobs are in the Midwest; so we've decided to cross that bridge when we come to it."

* * * * *

Items 34 through 47 refer to the following newspaper advertisement:

"Wanna buy a duct? If you're planning to install a warm air heating system, ask your contractor about the advantages of Blake Aluminum for duct-work. Many have already found it saves money because it's easier for workmen to handle, gives more long-run satisfaction because it never rusts, never needs painting, is always neat. Aluminum's natural insulation prevents excessive heat loss; sound is deadened too. Approved for FHA financing."

In this advertisement the writer makes a number of claims for his product. He also takes for granted a number of ideas about it, about prospective buyers of heating systems, etc. Mark each of the statements, 34 through 47, according to this scale:

1. The writer states this, although maybe not in just these words.
 2. The writer does not state this, but he does state something which shows that he must have taken it for granted.
 3. The writer does not state this, nor does it have any relation to his argument.
 4. The writer does not state this and it would weaken his argument if he did state it.
34. Installation expense is a significant item in considering the cost of heating equipment.
35. Ordinary ducts are harder to handle than aluminum ducts.
36. Some people are thinking of installing warm-air heating systems.
37. Aluminum ducts cost more than galvanized iron ducts.
38. Durability as well as initial expense should be considered in buying heating equipment.
39. Brick houses take a different shape of heating duct than do frame houses.
40. Some buyers of ducts live in the country.

41. Blake Aluminum ducts do save money for the buyer.

42. Delivery on orders for aluminum products is slow at present.

43. FHA approval for a building product is an asset.

44. The prospective buyer's contractor knows about Blake Aluminum ducts.

45. Blake Aluminum ducts may not be the best aluminum ducts on the market today.

46. A house in which sound is deadened is usually preferred to a house in which sound is not deadened.

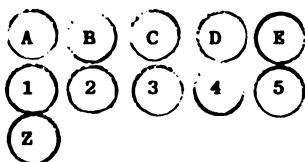
47. Ordinary galvanized ducts don't need to be painted anyway.

* * * * *

(Please go on to the next page)

Items 48 through 57 form a sequence based on a developing situation. In answering an item, consider only the information given you in it and in the preceding items. (Do not consider information presented in the items which follow. The correct choice in one item may appear to be incorrect if you consider information presented in later items.)

You find yourself stranded late at night in the deserted waiting room of a Balkonian airport. You are hungry. You find a large vending machine about which you know nothing. It has no display windows or pictures, and the directions are written in the Balkonian language; which you cannot understand at all. Beside the machine is a waste basket containing a few discarded food wrappers and beverage cups. On the front of the machine you find a coin slot the size of a Balkonian dollar, a delivery chute, and a panel of buttons arranged as follows:



You must depend upon your own ingenuity to operate the machine.

48. You insert a Balkonian dollar in the coin slot, but nothing happens. On the basis of the little information about the machine you now have, which of the following explanations of the machine's failure to operate would be most likely to be true? (NOTE: in answering this item, do not consider information presented in later items.)

1. You did not insert the right kind of coin.
2. You must push one or more of the buttons to make the machine operate.
3. You must push the button marked 2 to make the machine operate.
4. The machine is out of order.
5. The machine is empty.

49. You push the button marked A and nothing happens; then you push the 2 button and still nothing happens. Finally you push the 1 button, and the machine promptly delivers a package of peppermint chewing gum and three Balkonian quarters. On the basis of the little information given you up to and including this item (do not consider later items), which is the most likely explanation of the machine's behavior?

1. The machine will not operate unless the A button is pushed.
2. The machine will not operate unless the 2 button is pushed.
3. You must push a numbered button to make the machine operate.
4. The order in which the buttons are pushed determines whether the machine will operate.
5. The machine contains only chewing gum.

50. Since the gum does not satisfy your hunger, you risk another dollar, pushing, in order, buttons B 1 2 and getting a package of Elephant cigarettes, but no change. At this point which of the following is the most likely explanation of the machine's behavior? (NOTE: the choice you should mark is the one for which you now have the most evidence; the correct choice here may not prove to be the true explanation later.)

1. The numbered buttons determine the type of product (gum, cigarettes, etc.) delivered.
2. The A button causes change to be returned.
3. Buttons A B C D E determine the type of product delivered.
4. The 2 button causes change to be returned.
5. The machine contains only gum and cigarettes.

51. You are still hungry. Again you insert a dollar and push, in order, only buttons B and 2 and you get a package of Lion cigarettes (a different brand) and no change. For which of the following explanations do you have the most evidence at this point?

1. The machine contains only cigarettes and gum.
2. The 2 button must be pushed to secure change.
3. Pushing or not pushing the 2 button determines the particular brand or flavor of product dispensed.
4. The numbered buttons determine the particular brand or flavor of product dispensed.
5. The buttons A B C D E determine the particular brand or flavor of product dispensed.

52. You are still hungry. You push, in order, the buttons marked A 2 Z and you get a package of wintergreen chewing gum (a different flavor) and three Balkonian quarters in change. The evidence now in hand points most strongly to the theory that

1. different brands or flavors of products are delivered purely by chance.
2. the numbered buttons determine the brand or flavor of product delivered.
3. the order in which the buttons are pressed determines whether or not change is returned.
4. change is returned only when the A button is pushed.
5. the 2 button must be pressed in order to get change.

53. Still hungry, you try again. You push, in order, buttons (C) (3) (Z). The machine promptly delivers a cup of steaming, unsweetened black coffee and two quarters. On the basis of this information, the best explanation of the machine's operation is:

1. You get change according to the price of the product, not according to the buttons you push.
2. You must push the (Z) button to get change.
3. You must push the (A) button to get change.
4. You must push the (3) button to get coffee.
5. You must push the (Z) button to make the machine operate.

The results you have obtained so far are summarized below. A dollar was inserted each time.

<u>Buttons Pushed</u>			<u>Results Obtained</u>
(A)	(Z)	(1)	1 pkg. peppermint gum and 3 quarters
(B)	(1)	(Z)	1 pkg. Elephant cigarettes, but no change
(B)	(2)		1 pkg. Lion cigarettes, but no change
(A)	(2)	(Z)	1 pkg. wintergreen chewing gum and 3 quarters
(C)	(3)	(Z)	black, unsweetened coffee and 2 quarters

54. You like your coffee with cream. Which of the following combinations of buttons now seems most likely to deliver this?

1. (C) (A) (1)
2. (Z) (A) (1)
3. (C) (E) (2)
4. (C) (4) (Z)
5. (A) (B) (C)

55. You push buttons (D) and (5) and get a ham sandwich but no change. Which one of the following explanations is most likely?

1. The machine contains only one variety of sandwich.
2. You do not get a sandwich if you push the (Z) button.
3. You must buy coffee before you can get a sandwich.
4. You must push the (D) button to get a sandwich.
5. You must push the (5) button to get a sandwich.

56. By this time one sandwich is not enough. You try buttons (Z) (D) (5) and get another ham sandwich and one quarter in change. The evidence you now have points clearly to which of the following explanations of how change is delivered?

1. Change is returned automatically by the machine according to the price of the product; the buttons have nothing to do with it.
2. Change is returned according to the price of the product, but only when the (Z) button is pushed.
3. The order in which the buttons are pushed determines the change.
4. You must push one of the odd-numbered buttons to get change.
5. You must push buttons (A) or (B) to get change.

57. You have now tried all of the lettered buttons except (E). Which of the following products, according to the evidence now on hand, is most likely to be controlled by this button?

1. Handkerchiefs
2. Pocket-size books
3. Coffee with cream
4. Candy
5. A third brand of cigarettes

**Cooperative Study of Evaluation in General Education
of the
American Council on Education**

CRITICAL ANALYSIS TEST

Paul B. Diederich

DIRECTIONS: This test will require an analysis and comparison of the three passages that are printed on page 2. The passages discuss essentially the same subject from different points of view, and it will be your first task to discover what this subject is. Then there will be two sets of questions:

1. questions on the passages themselves,
2. questions on a paper written about these passages by a college freshman.

For all questions, blacken the answer space corresponding to the best answer. There are no strict time limits, but most students will be able to finish easily within a fifty-minute period.

Before beginning the test, fill in the blanks at the side of the answer sheet.

I

The nation, with all its so-called internal improvements, which are all external and superficial, is just an unwieldy and overgrown establishment, cluttered with furniture and tripped up by its own traps, ruined by luxury and heedless expense, by want of calculation and a worthy aim; and the only cure for it is in a rigid economy, a stern and more than Spartan simplicity of life and elevation of purpose. It lives too fast. Men think it essential that the Nation have commerce, and talk through a telegraph, and ride thirty miles an hour, whether they do or not; but whether we should live like baboons or like men is a little uncertain. If we do not get out sleepers,* and forge rails, and devote days and nights to the work, but go to tinkering upon our lives to improve them, who will build railroads? And if railroads are not built, how shall we get to heaven in season? But if we stay at home and mind our business, who will want railroads? We do not ride on the railroad, it rides upon us. Did you ever think what those sleepers are that underlie the railroad? Each one is a man, an Irishman, or a Yankee man. The rails are laid on them, and they are covered with sand, and the cars run smoothly over them. They are sound sleepers, I assure you. And every few years a new lot is laid down and run over; so that, if some have the pleasure of riding on a rail, others have the misfortune to be ridden upon. And when they run over a man that is walking in his sleep and wake him up, they suddenly stop the cars and make a hue and cry about it, as if this were an exception. I am glad to know that it takes a gang of men for every five miles to keep the sleepers down and level in their beds, for this is a sign that they may sometime get up again.

II

Myself when young did eagerly frequent
Doctor and Saint, and heard great argument
About it and about: but evermore
Came out by the same door where in I went.

With them the seed of wisdom did I sow,
And with mine own hand wrought to make it grow;
And this was all the harvest that I reaped--
"I came like water, and like wind I go."

Into this universe, the why not knowing
Nor whence, like water willy-nilly flowing;
And out of it, as wind along the waste,
I know not whither, willy-nilly blowing.

Waste not your hour, nor in the vain pursuit
Of This and That endeavor and dispute;
Better be jocund with the fruitful grape
Than sadden after none, or bitter, fruit.

The moving finger writes; and, having writ,
Moves on: nor all your piety nor wit
Shall lure it back to cancel half a line,
Nor all your tears wash out a word of it.

* sleepers= railroad ties

III

No man can serve two masters: for either he will hate the one and love the other; or else he will hold to the one and despise the other. Ye cannot serve God and mammon.

Therefore I say unto you, Take no thought for your life, what ye shall eat, or what ye shall drink; nor yet for your body, what ye shall put on. Is not the life more than meat, and the body than raiment? Behold the fowls of the air: for they sow not, neither do they reap, nor gather into barns; yet your Heavenly Father feedeth them. Are ye not much better than they?

Which of you by taking thought can add one cubit unto his stature?

And why take ye thought for raiment? Consider the lilies of the field, how they grow; they toil not, neither do they spin: and yet I say unto you that even Solomon in all his glory was not arrayed like one of these.

Wherefore if God so clothe the grass of the field, which today is, and to-morrow is cast into the oven, shall he not much more clothe you, O ye of little faith? Therefore, take no thought, saying, what shall we eat? or, What shall we drink? or, Wherewithal shall we be clothed? For after all these things do the Gentiles seek: for your heavenly Father knoweth that ye have need of all these things. But seek ye first the kingdom of God and his righteousness; and all these things shall be added unto you.

Take therefore no thought for the morrow: for the morrow shall take thought for the things of itself. Sufficient unto the day is the evil thereof.

Part I

DIRECTIONS: Mark the best answer.

- Which of the following questions is the central concern of all three passages?
 - Is the pursuit of pleasure a desirable goal in life?
 - Is hard work necessary for success in life?
 - What should be our chief purpose in life?
 - Is the pursuit of material values contrary to religion?
- Which of the following best represents the goal proposed in Passage I?
 - The development of the Nation.
 - Simplicity and elevation of purpose.
 - To ride upon the railroad rather than to be ridden upon.
 - To keep the sleepers down and level in their beds.
- Which of the following best represents the opposite of the goal proposed in Passage I?
 - The Nation.
 - Spartan simplicity.
 - The sleepers.
 - Building railroads.

4. Which of the following best represents the goal proposed in Passage II?
 1. To sow the seed of wisdom.
 2. To come like water and to go like wind.
 3. To be jocund with the fruitful grape,
 4. To do whatever the moving finger writes.
5. Which of the following best represents the opposite of the goal proposed in Passage II?
 1. Doctor and Saint.
 2. Sowing the seed of wisdom.
 3. Whatever the moving finger writes.
 4. Endeavor and dispute over This and That.
6. Which of the following best represents the goal proposed in Passage III?
 1. The kingdom of God and his righteousness.
 2. Sufficient unto the day is the evil thereof.
 3. Take no thought for your life.
 4. Refrain from any sort of labor.
7. Which of the following best represents the opposite of the goal proposed in Passage III?
 1. Mammon.
 2. The morrow.
 3. Food and clothing.
 4. Hard work of any kind.
8. Which of the following descriptions of man's role in life as conceived in these passages is least accurate?
 1. I: Man is a tool-using animal.
 2. II: Man is a puppet of fate.
 3. III: Man is a child of God.
9. Which passage expresses concern over the exploitation of workmen in the pursuit of material values?
 1. Passage I.
 2. Passage II.
 3. Passage III.
 4. None of them.
10. Which passage places chief emphasis upon service to others?
 1. Passage I.
 2. Passage II.
 3. Passage III.
 4. None of them.
11. Which passage or passages emphasize simplicity as essential to a good life?
 1. All, about equally.
 2. None of them.
 3. Passages I and III.
 4. Passage II.
12. Which of these views is based on the feeling that there are no answers, that effort is useless?
 1. Passage I.
 2. Passage II.
 3. Passage III.
 4. None of them.
13. Passages II and III both deny the value of "taking thought." How do they differ?
 1. II regards thought as unrewarding; III as a necessary evil.
 2. II refers to thought about philosophic issues; III to thought about making a living.
 3. II prefers action to thought; III prefers faith.
 4. II refers to thought about fate; III to thought about God.
14. All three passages seem to regard material possessions as unimportant. Which statement of their reason for thinking so is least accurate?
 1. We should reduce our wants rather than increase our means of satisfying them.
 2. It is pleasanter to drink wine.
 3. Striving for worldly goods interferes with the service of God.
15. In which of the following ways are the "sleepers" in Passage I like the "lilies" in Passage III?
 1. Both are subjects of parables.
 2. Both illustrate how men should act.
 3. Both illustrate what happens to people who concentrate on material things.
 4. Both illustrate the advantages of simplicity.
16. Which of the following pairs of passages are closest together in point of view?
 1. I and II.
 2. I and III.
 3. II and III.
17. Which passage or passages emphasize the thought expressed in the following quotation?
 "The world is too much with us;
 late and soon,
 Getting and spending, we lay waste
 our powers."
 1. All of them.
 2. None of them.
 3. I and III.
 4. II.

(Go on to the next page.)

18. Which passage agrees with the thought expressed in the following quotation:
"Life's but a walking shadow, a poor player
That struts and frets his hour upon
the stage,
And then is heard no more; it is a tale
Told by an idiot, full of sound and fury,
Signifying nothing."

1. Passage I.
2. Passage II.
3. Passage III.
4. None of them.

19. Which passage agrees with the point of view expressed in the following quotation:
"Go to the ant, thou sluggard;
Consider her ways, and be wise:
Which having no chief,
Overseer or ruler,
Provideth her meat in the summer,
And gathereth her food in the harvest."

1. Passage I.
2. Passage II.
3. Passage III.
4. None of them.

20. Which passage emphasizes the thought expressed in the following quotation:
"And the great cry that rises from our manufacturing cities, louder than their furnace blast, is all in very deed for this,--that we manufacture everything there except men; we blanch cotton, and strengthen steel, and refine sugar, and shape pottery; but to brighten, to strengthen, to refine, or to form a single living spirit never enters into our estimate of advantages."

1. Passage I.
2. Passage II.
3. Passage III.
4. None of them.

PART II

DIRECTIONS: First, read the following paper. The student was asked to review and compare the positions of the three authors and then to state his own.

1 The three authors regard success in
2 a job as unimportant because many in
3 obtaining success use others as stepping
4 stones. Success is seeing the good in
5 others and living a good life.

6 Passage I considers any improvement
7 in mechanical things as unnecessary and
8 unsuccessful because thousands of people
9 are often hurt in making the improvement.

10 Passage II says learning is important;
11 it also says that if you're going to do
12 anything, don't do something you'll regret,
13 for what's done can't be undone.

14 Passage III stresses the point that
15 you shouldn't struggle for material things;
16 food and clothing are nothing compared to
17 everlasting life.

18 All the authors agree that in success
19 there is happiness, and there is no
20 happiness in gains made crookedly.

21 I believe success in work can't be
22 the most important element in life but
23 is very important. Being successful in
24 business doesn't necessarily mean that
25 you're leading a good life. Many success-
26 ful people have reached their goal by
27 robbing and cheating others. Success in
28 business often leads to conceit, and many
29 successful people can't see the beauty in
30 life for thinking only of themselves.

31 Success in business is important in
32 that it proves you can accomplish something.
33 It is a good thing if you reach your goal
34 honestly and get happiness out of your
35 success. Many successful people aren't
36 happy.

37 The real success in life is happiness
38 and making others happy. Many people
39 are so busy rushing toward their goal that
40 they haven't time to be happy. I believe
41 success in business is important if you
42 don't let it obstruct your vision so that
43 you can't see good in people, and it takes
44 up all your time.

DIRECTIONS: Mark the best answer to each of the following questions.

21. In items 21-29 assume that this student's purpose was to show that success in work is important, provided that--and he mentioned all of the following but one. Which one did he overlook?

1. Provided that it is honestly attained.
2. Provided that it brings happiness in itself and leaves time for other forms of happiness.
3. Provided that it makes a constructive contribution to the common welfare.
4. Provided that it does not inflate the ego and prevent seeing good in others.

22. In the light of this purpose, as stated in Item 21, his review of the passages is

1. adequate, for he covers their chief objections to regarding success in work as important.
2. adequate, for he points out that the only fundamental objection is to dishonest success in work.
3. inadequate, for he includes only what is relevant to his purpose and leaves out many other points that could be made.
4. inadequate, for he neither recognizes nor refutes important objections to his position that may be found in the passages.

23. In the light of this purpose, as stated in Item 21, the opening sentence
1. starts at a good point in reviewing the passages and immediately shows their only serious objection to his own position.
 2. starts at a good point but immediately falls into a misinterpretation.
 3. starts at a bad point; he first should point out what these passages say in favor of his position.
 4. starts at a bad point; he should first tell what each passage said before pointing to any conclusion that they hold in common.
24. In the light of this purpose, as stated in Item 21, the sentence in lines 37-38
1. is the logical conclusion toward which his whole argument is directed.
 2. is one of the major reasons upon which his conclusion is based.
 3. is only a restatement of his conclusion in slightly different terms.
 4. is irrelevant to and inconsistent with his conclusion.
25. The student attempts to show that "success in work is important" by
1. first refuting the objections of the three passages and then building up his own case.
 2. setting up a straw man by misstating the objections of the three passages and then knocking it down.
 3. overlooking or misstating the objections of the three passages and then chiefly asserting and qualifying his conclusion.
 4. the propaganda devices of name-calling, begging the question, exaggeration, and reiteration without proof.
26. The student misinterprets at least one point in his review of each passage, but everything he says about one of the passages is a misinterpretation. Which passage is that?
1. Passage I.
 2. Passage II.
 3. Passage III.
27. At what point in the paper does the student's development of his own position begin?
1. In line 18.
 2. In line 21.
 3. In line 31.
 4. In line 37.
28. There is one logical argument in support of the student's conclusion. In which of the following lines does it occur?
1. In lines 23-25.
 2. In lines 27-30.
 3. In lines 31-32.
 4. In lines 37-38.
29. Which of the following is the best comment on the student's own arguments in support of his conclusion?
1. They are true as far as they go, but the argument is incomplete.
 2. They are chiefly repetitions of the conclusion in different terms, not arguments to support it.
 3. They sound plausible but commit many logical fallacies.
 4. There are about twice as many statements opposed to his conclusion as there are in favor of it.
30. Lines 3-4, "use others as stepping stones." This phrase is suggested by
1. the remarks about the "sleepers" in Passage I.
 2. a misinterpretation of what Passage II means by "the moving finger."
 3. the position of all three authors.
 4. nothing that is stated or implied in any of the three passages.
31. Lines 4-5. This sentence is
1. intended as a statement of the position of the three authors.
 2. intended as a statement of the writer's own position.
 3. intended as a statement both of the writer's own position and of that of the three authors.
 4. not clear as to which position is intended.
32. Lines 21-30. This paragraph
1. is a fair statement of the main point at issue.
 2. misses the point, which is whether even honest success in work is an essential element of the good life.
 3. misses the point, which is whether individual success makes for social progress.
 4. misses the point, because none of the passages mentions "conceit."
33. Lines 31-32. This sentence is
1. good, because it gives a reason for regarding success in work as important.
 2. good, because it makes no mistakes in grammar or punctuation.
 3. poor, because "something" is vague.
 4. poor, because no one needs to be told why success in business is important.

(Go on to the next page.)

34. Lines 37-38. Compare this sentence with the sentence in lines 4-5.
1. The writer is inconsistent in these two sentences.
 2. The writer is consistent because the two sentences mean the same thing.
 3. The writer is consistent if the first sentence is taken as the position of the three authors while the second is taken as his own position.
 4. Even so, the writer is inconsistent, because "happiness" is not necessarily the same thing as "living a good life."
35. Lines 8-9. Which is the most accurate interpretation of what Passage I meant?
1. people are often hurt
 2. workmen are injured
 3. investors are defrauded
 4. lives are used up
36. Line 10. Which is the most accurate interpretation of what Passage II meant?
1. important
 2. vital
 3. insufficient
 4. useless
37. Lines 11-15. Which is the most accurate interpretation of what Passage II meant?
1. if you're going to do anything, don't do something you'll regret, for what's done can't be undone.
 2. if you have to decide on a course of action, be very careful, for one mistake may ruin you.
 3. striving to accomplish anything is futile, because everything that happens is determined by fate.
 4. life should be devoted to pleasure, because it will end soon enough anyway.
38. Line 17. Which is the most accurate interpretation of what Passage III meant?
1. everlasting life.
 2. health and success in life.
 3. the birds and the lilies.
 4. the service of God.
39. Line 20. Which is the most accurate interpretation of all three passages?
1. gains made crookedly.
 2. ill-gotten gains.
 3. material wealth.
 4. the fruitful grape.
40. Line 43. Which states most accurately what the student means?
1. it takes
 2. it does not take
 3. if you let it take
 4. if you don't let it take

* * * * *
END OF TEST

Cooperative Study of Evaluation in General Education
of the
American Council on Education

INVENTORY OF BELIEFS

FORM I

This inventory consists of 120 statements which range over a wide variety of topics. As you read each statement you are asked to indicate quickly your agreement or disagreement with it in terms of the key given below. People have different reactions to these statements. This is not a test in which there are "right" and "wrong" answers. What is wanted here is your own quick personal reaction. You should be able to finish taking the inventory in 30 minutes or less.

In responding to these statements you will notice that there is no way provided for indicating a neutral position. It is desired that you indicate a tendency toward either agreement or disagreement even though you may prefer to remain undecided. It is important that you respond to every one of the 120 statements.

Before beginning work please record at the top of your answer sheet (1) your name, (2) date, (3) the name of your school, (4) your sex, (5) your academic class i.e., (Freshman, Sophomore, etc.), and (6) the name of this inventory.

The key you are to use in responding to these statements is reproduced at the top of each page. (Note that you will never use the fifth response space on your answer sheet.)

Key: 1. I strongly agree or accept the statement.
2. I tend to agree or accept the statement.
3. I tend to disagree or reject the statement.
4. I strongly disagree or reject the statement.

1. If you want a thing done right, you have to do it yourself.
2. There are times when a father, as head of the family, must tell the other family members what they can and cannot do.
3. Lowering tariffs to admit more foreign goods into this country lowers our standard of living.
4. Literature should not question the basic moral concepts of society.
5. Reviewers and critics of art, music and literature decide what they like and then force their tastes on the public.
6. Why study the past, when there are so many problems of the present to be solved.
7. Business men and manufacturers are more important to society than artists or musicians.
8. There is little chance for a person to advance in business or industry unless he knows the right people.
9. Man has an inherent guide to right and wrong--his conscience.
10. The main thing about good music is lovely melody.
11. It is only natural and right for each person to think that his family is better than any other.
12. All objective data gathered by unbiased persons indicate that the world and universe are without order.
13. Any man can find a job if he really wants to work.
14. We are finding out today that liberals really are soft-headed, gullible, and potentially dangerous.
15. A man can learn as well by striking out on his own as he can by following the advice of others.
16. The predictions of economists about the future of business are no better than guesses.
17. Being a successful wife and mother is more a matter of instinct than of training.
18. A person often has to get mad in order to push others into action.
19. There is only one real standard in judging art works--each to his own taste.
20. Business enterprise, free from government interference, has given us our high standard of living.
21. Nobody can make a million dollars without hurting other people.
22. Anything we do for a good cause is justified.
23. Public resistance to modern art proves that there is something wrong with it.
24. Sending letters and telegrams to congressmen is mostly a waste of time.
25. Many social problems would be solved if we did not have so many immoral and inferior people.
26. Art which does not tell a human story is empty.
27. You can't do business on friendship: profits are profits; and good intentions are not evidence in a law court.
28. A person has troubles of his own; he can't afford to worry about other people.
29. Books and movies should start dealing with entertaining or uplifting themes instead of the present unpleasant, immoral, or tragic ones.
30. Children should be made to obey since you have to control them firmly during their formative years.

- Key: 1. I strongly agree or accept the statement.
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31. The minds of many youth are being poisoned by bad books.
32. Speak softly, but carry a big stick.
33. Ministers in churches should not preach about economic and political problems.
34. Each man is on his own in life and must determine his own destiny.
35. New machines should be taxed to support the workers they displace.
36. The successful merchant can't allow sentiment to affect his business decisions.
37. Ministers who preach socialistic ideas are a disgrace to the church.
38. Labor unions don't appreciate all the advantages which business and industries have given them.
39. It's only natural that a person should take advantage of every opportunity to promote his own welfare.
40. We should impose a strong censorship on the morality of books and movies.
41. The poor will always be with us.
42. A person who is incapable of real anger must also be lacking in moral conviction.
43. If we allow more immigrants into this country, we will lower our standard of culture.
44. People who live in the slums have no sense of respectability.
45. We acquire the highest form of freedom when our wishes conform to the will of society.
46. Modern paintings look like something dreamed up in a horrible nightmare.
47. Voting determines whether or not a country is democratic.
48. The government is more interested in winning elections than in the welfare of the people.
49. Feeble-minded people should be sterilized.
50. In our society, a person's first duty is to protect from harm himself and those dear to him.
51. Those who can, do; those who can't, teach.
52. The best government is one which governs least.
53. History shows that every great nation was destroyed when its people became soft and its morals lax.
54. Philosophers on the whole act as if they were superior to ordinary people.
55. A woman who is a wife and mother should not try to work outside the home.
56. We would be better off if people would talk less and work more.
57. In some elections there is not much point in voting because the outcome is fairly certain.
58. The old masters were the only artists who really knew how to draw and paint.
59. Most intellectuals would be lost if they had to make a living in the realistic world of business.
60. You cannot lead a truly happy life without strong moral and religious convictions.

Key: 1. I strongly agree or accept the statement.
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61. If we didn't have strict immigration laws, our country would be flooded with foreigners.
62. When things seem black, a person should not complain, for it may be God's will.
63. Miracles have always taken place whenever the need for them has been great enough.
64. Science is infringing upon religion when it attempts to delve into the origin of life itself.
65. A person has to stand up for his rights or people will take advantage of him.
66. A lot of teachers, these days, have radical ideas which need to be carefully watched.
67. Now that America is the leading country in the world, it's only natural that other countries should try to be like us.
68. Most Negroes would become overbearing and disagreeable if not kept in their place.
69. Foreign films emphasize sex more than American films do.
70. Our rising divorce rate is a sign that we should return to the values which our grandparents held.
71. Army training will be good for most modern youth because of the strict discipline they will get.
72. When operas are sung in this country they ought to be translated into English.
73. People who say they're religious but don't go to church are just hypocrites.
74. What the country needs, more than laws or politics, is a few fearless and devoted leaders in whom the people can have faith.
75. Pride in craftsmanship and in doing an honest day's work is a rare thing these days.
76. The United States may not have had much experience in international dealings but it is the only nation to which the world can turn for leadership.
77. In practical situations, theory is of very little help.
78. No task is too great or too difficult when we know that God is on our side.
79. A sexual pervert is an insult to humanity and should be punished severely.
80. A lot of science is just using big words to describe things which many people already know through common sense.
81. Manual labor and unskilled jobs seem to fit the Negro mentality and ability better than more skilled or responsible work.
82. A person gets what's coming to him in this life if he doesn't believe in God.
83. Public officials may try to be honest but they are caught in a web of influence which tends to corrupt them.
84. Science makes progress only when it attempts to solve urgent practical problems.
85. Most things in life are governed by forces over which we have no control.
86. Young people today are in general more immoral and irresponsible than young people of previous generations.
87. Americans may tend to be materialistic, but at least they aren't cynical and decadent like most Europeans.
88. The many different kinds of children in school these days force teachers to make a lot of rules and regulations so that things will run smoothly.
89. Jews will marry out of their own religious group whenever they have the chance.
90. The worst danger to real Americanism during the last 50 years has come from foreign ideas and agitators.

- Key: 1. I strongly agree or accept the statement.
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| 91. Europeans criticize the United States for its materialism but such criticism is only to cover up their realization that American culture is far superior to their own. | 106. Members of religious sects who refuse to salute the flag should be punished for their lack of patriotism. |
| 92. The scientist that really counts is the one who turns theories into practical use. | 107. Political parties are run by insiders who are not concerned with the public welfare. |
| 93. No one can really feel safe when scientists continue to explore whatever they wish without any social or moral restraint. | 108. As young people grow up they ought to get over their radical ideas. |
| 94. Nudist colonies are a threat to the moral life of a nation. | 109. Negroes have their rights, but it is best to keep them in their own districts and schools and to prevent too much contact with whites. |
| 95. One trouble with Jewish businessmen is that they stick together and prevent other people from having a fair chance in competition. | 110. The twentieth century has not had leaders with the vision and capacity of the founders of this country. |
| 96. No world organization should have the right to tell Americans what they can or cannot do. | 111. There are a lot of things in this world that will never be explained by science. |
| 97. There is a source of knowledge that is not dependent upon observation. | 112. Sexual relations between brother and sister are contrary to natural law. |
| 98. Despite the material advantages of today, family life now is not as wholesome as it used to be. | 113. There may be a few exceptions, but in general Jews are pretty much alike. |
| 99. The United States doesn't have to depend on the rest of the world in order to be strong and self-sufficient. | 114. The world will get so bad that some of these times God will destroy it. |
| 100. Foreigners usually have peculiar and annoying habits. | 115. Children should learn to respect and obey their teachers. |
| 101. Parents know as much about how to teach children as public school teachers. | 116. Other countries don't appreciate as much as they should all the help that America has given them. |
| 102. The best assurance of peace is for the United States to have the strongest army, navy, air force, and the most atom bombs. | 117. We would be better off if there were fewer psychoanalysts probing and delving into the human mind. |
| 103. Some day machinery will do nearly all of man's work, and we can live in leisure. | 118. American free enterprise is the greatest bulwark of democracy. |
| 104. There are too many people in this world who do nothing but think about the opposite sex. | 119. If a person is honest, works hard, and trusts in God, he will reap material as well as spiritual rewards. |
| 105. Modern people are superficial and tend to lack the finer qualities of manhood and womanhood. | 120. One will learn more in the school of hard knocks than he ever can from a textbook. |

A LIMITED BIBLIOGRAPHY IN THE AREAS OF GENERAL EDUCATION;
STUDENT INTERESTS; CRITICAL THINKING AND EVALUATION.

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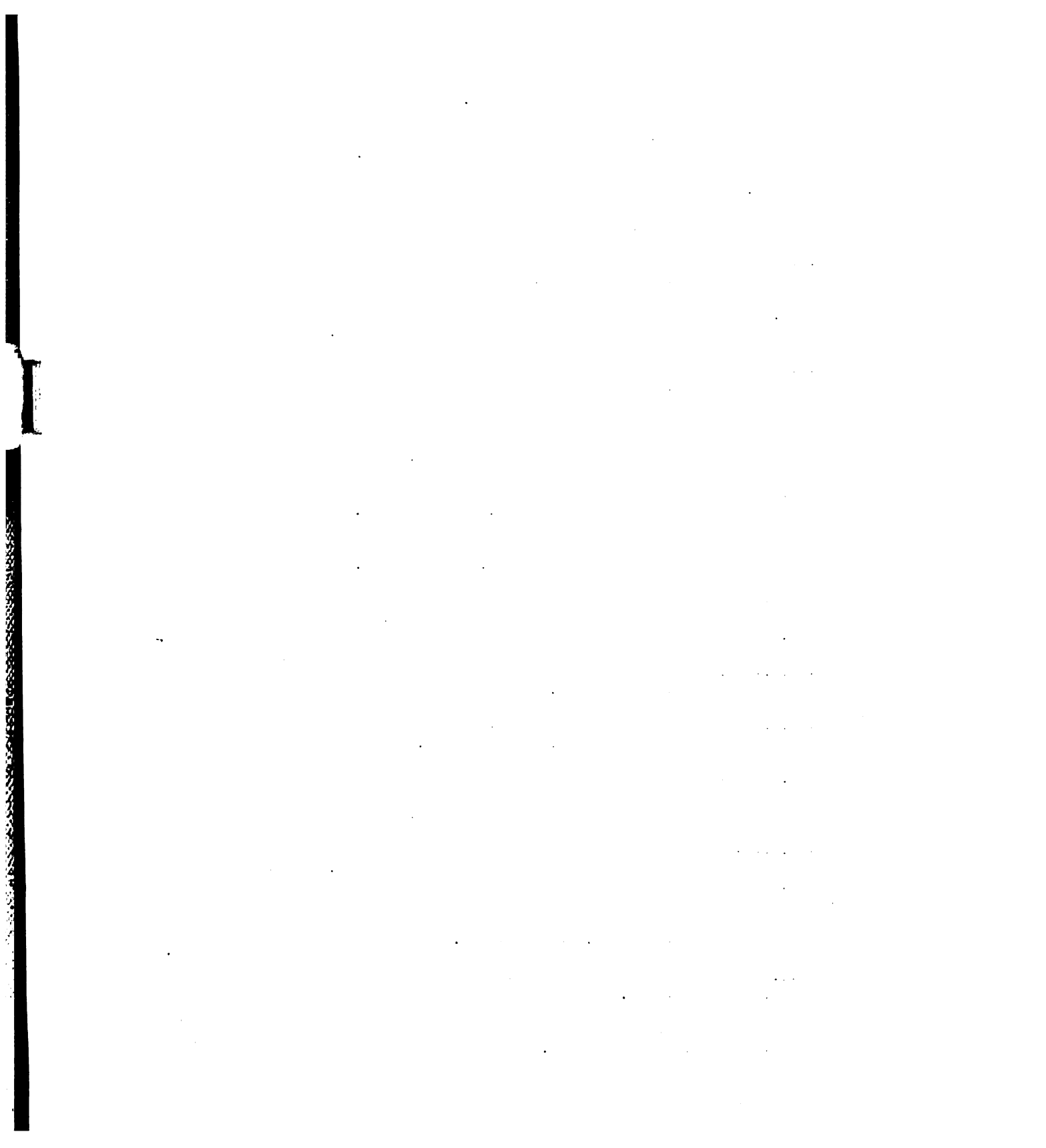
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