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## An Investigation of the Relationship between Skill in Deductive Reasoning and Adjustment and between Skill in Problem Solving and Adjustment at Various Levels of Education

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AN INVESTIGATION OF THE RELATIONSHIP BETWEEN  
SKILL IN DEDUCTIVE REASONING AND ADJUSTMENT  
AND BETWEEN SKILL IN PROBLEM  
SOLVING AND ADJUSTMENT AT  
VARIOUS LEVELS OF EDUCATION

by

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A Thesis Submitted to the Faculty of the Graduate School  
of Loyola University in Partial Fulfillment of  
the Requirements for the Degree of  
Master of Arts

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## CHAPTER I

### INTRODUCTION

What is the relationship between reasoning and human adjustment? Herein lies the focal point of this study. It immediately implies, however, another question. Is there a relationship between reasoning and adjustment? To this latter one, an affirmative answer is being assumed. The writing and research of today indicate that it would be almost a retreat to the psychology of quarter of a century ago to assume otherwise. The suggested components of the human person, or personality, if they are not becoming more numerous than they already are in many "omnibus" definitions are definitely beginning to assume proportions more fitting to the living human being they are attempting to define. Therefore it would be an ill-advised psychologist who would deny the possible functioning of any of these components, or at least of one so important as intelligence in the daily life of the human person, even if he should prefer to call them by another name. And since, in one way, the day to day life of man can be called a continual adjustment, the point of this study has again been suggested. What is the relationship between reasoning and human adjustment? These few thoughts have been very nicely summarized by Royce.

When we discussed the rational powers of man in explaining the definition of personality, we called attention to the swing back toward a recognition of the place of intellect in adjustment. Although the true nature of intellectual as distinct from sensory perception is ignored by many, no one questions intelligence as a factor in total personality.<sup>1</sup>

There is a connection between these two terms, reasoning and adjustment. It is the purpose of this work to try to make a little less obscure some small part of the nature of that relationship.

In the quotation from Royce just given above, allusion is made to a possible hazard in discussing material such as this; namely, the difference in terminology. Several words and phrases, such as reasoning, intelligence, rational powers and intellect, have been used in such a context as to suggest, quite properly, a similarity of meaning among them, although a logical definition of each would not reveal them to be identical. Since it is not the purpose of this paper to argue for the rational nature of man, the meaning of these terms will be understood as referring to that in the nature of man which makes him essentially different from all other animate bodies. It is interesting to note that other similar names which various writers may chose to use, in addition to the ones just mentioned, such as thinking, problem solving, mental activity or abstraction, frequently describe activities which find their likeness within a scholastic discussion of the acts of the intellect. In part then, this study is concerned with

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<sup>1</sup> James E. Royce, S.J., Personality and Mental Health, Milwaukee, 1955, 70.

the intellect, a capacity in man that has no counterpart in the rest of the animal world, although the indiscriminate use of common terminology may confuse the issue.

Some definitions and explanations will, however, be necessary at this point. The intellect is that specifically different capacity in man by which he knows things in an immaterial way and by which he discerns or recognizes the inner nature or essence of things. It has three different functions; conception, judgment and reasoning, terms which certainly are not strangers to psychological literature. It is not necessary to define all three since only the last one is under discussion. Maher defines reasoning as "that operation by which we derive a new judgment from some other judgment or judgments previously known."<sup>2</sup> There are two valid forms of reasoning by which the mind can acquire truth, deduction and induction.<sup>3</sup> These two words may be familiar to some because of their association with logic and rational psychology; others may know them from their discussion of procedures and methods in psychological investigation. In either case, these terms involve the same two ideas. Deduction is

the legitimate inference from the more general to the less general, from a law or principle to a particular instance falling under the law or principle. It proceeds from the

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<sup>2</sup> Michael Maher, S.J., Psychology: Empirical and Rational, London, 1919, 320.

<sup>3</sup> The establishment of the validity of these two forms of reasoning is the work of epistemology.

universal to the particular, from the simple to the complex, from the logical whole to the logical part, from the general law to the individual cases, from the cause to the effect.<sup>4</sup>

Induction is

the legitimate inference of universal laws from individual cases. It passes from the particular to the universal, from the complex to the simple, from the phenomena to the underlying general law, from the effect to the cause.<sup>5</sup>

Perhaps the meaning of deduction and induction can be further illustrated by showing how they apply to what is called the scientific method of investigation, or the inductive method of scientific investigation. In this method the first step is the observation of certain phenomena and the gathering of data; the second is the formulation of tentative hypotheses derived from the observed facts. This can be recognized as the inductive stage. Then the investigator deduces from these hypotheses certain theorems or conclusions which would logically flow from it if the hypotheses were true; and finally he submits these theorems to experimental verification to confirm or disconfirm the hypotheses themselves. This last part comprises the deductive stage of the method. Actually, there is a constant intermingling of the two forms of reasoning, but this rather broad dichotomy is made by those writing on the scientific method.

It might be well to stop here and explain why emphasis

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4 Celestine N. Bittle, O.M.Cap., Reality and the Mind, Milwaukee, 1936, 7.

5 Ibid.



is being given to such intangibles as induction and deduction, the two forms of reasoning, when one could settle with the concept of intelligence and a concrete score or an IQ test. First of all, one of the key words in this study is reasoning, and not intelligence. An exhaustive definition of intelligence is something that even the most naive should hesitate to attempt. Secondly, the introductory paragraphs began to point out that intelligence is involved somehow in the adjustment of the human person. But the general concept of intelligence compared with adjustment is too broad an investigation simply because the concept of intelligence involves too many factors which have not been definitely determined or adequately defined. However, a perusal of several IQ tests should readily reveal the use of inductive and deductive material that answers to the definition of these terms which has just been given. Many workers in the field of intelligence have considered the ability to reason as one of the primary mental capacities. A general reasoning factor has been the subject of investigation by others. So far, they feel it probably has something to do with ability in problem solving and the formulation of complex conceptions of many kinds.<sup>6</sup> The point is this. Since in some way, intelligence seems to involve inductive and deductive mental capacities, these two more specific factors were selected

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<sup>6</sup> J. P. Guilford, Norman W. Kettner and Paul R. Christensen, "The Nature of the General Reasoning Factor," Psychological Review, LXIII, 1956, 171-172.

for the purpose of comparing skill in them with adjustment. The second chapter will explain what materials were chosen as representative tests of these two forms of reasoning.

The term adjustment is not easy to define, either. According to the dictionary, to adjust means to settle or arrange, to bring into proper relations, or to put in order. Symonds has the following terse comment that adjustment is "adaptation to the demands of reality."<sup>7</sup> This statement and the phrases from the dictionary comprise all that is needed for a description suitable to the present study. Adjustment is the establishment and maintenance of the proper<sup>8</sup> order between the individual person and reality composed of himself, the animate and inanimate environment, and God, which continually makes demands upon him by the very fact of his contact with it. This working definition fits in with the statement made earlier that the daily life of man is a continual adjustment, i.e., an ordering of his relations with all other beings.

The problem again presents itself. What part does intelligence, or more specifically inductive and deductive reasoning, have in adjustment? Books, or parts of them devoted to adjustment suggest several connections; and it is precisely state-

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<sup>7</sup> Percival M. Symonds, The Dynamics of Human Adjustment, New York, 1946, 1.

<sup>8</sup> It is beyond the scope of this paper to discuss what would constitute the proper order in adjustment.

ments such as these, especially if unaccompanied by verification of any kind, that stimulate investigation.

Bernard has the following:

Thinking, or more specifically, problem solving is a means of increasing the behavior variability which tends to make for efficient, harmonious, and happy living. When a person can do effective thinking, he has a better chance to make adequate adjustment to the problems he encounters.<sup>9</sup>

Here the author seems to consider problem solving as one essential for adequate adjustment. Furthermore, in the four steps in thinking that he enumerates, recognition of a problem and the gathering of information, formulation of the hypotheses, testing the hypotheses and making generalizations, the inductive method of scientific investigation, mentioned earlier, can easily be discerned. (In Chapter Two, problem solving as a primarily inductive activity will be discussed.)

Crow and Crow state that a person's degree of mental growth and development is closely connected with suitable adjustment.

Fortunate is the person who develops early an intelligent and scientific approach to the problems that confront him as he strives toward life adjustment. The young person who is trained in sound techniques of problem solving is being helped to establish thinking habits that can be of great service to him throughout his entire life.<sup>10</sup>

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<sup>9</sup> Harold W. Bernard, Toward Better Personal Adjustment, New York, 1951, 281.

<sup>10</sup> Lester D. Crow and Alice Crow, Understanding our Behavior: The Psychology of Personal and Social Adjustment, New York, 1956, 69.

Here again the emphasis is on thinking and problem solving, and the authors give five steps very similar to those of Bernard in their description of the thinking process as one type of mental activity.

Royce, in a passage already quoted, notes the increasing recognition given to the role of intellect in adjustment. Schneiders defines adjustment as a "process involving both mental and behavioral responses...."<sup>11</sup> The mental, the thinking capacities are here in the definitions and in the books, and so are the questions necessarily implied therein.

Is one act of the intellect more important than the others? What type of mental activity contributes more fully to adjustment? Which form of reasoning is associated with what kind of adjustment? The last question introduces the specific aspect of the broad general problem with which this paper is concerned; namely, the relationship between skill in deductive reasoning and adjustment, and between problem solving and adjustment at two different levels of education.

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<sup>11</sup> Alexander A. Schneiders, Personal Adjustment and Mental Health, New York, 1955, 51.

## CHAPTER II

### EXPERIMENTAL MATERIALS AND PROCEDURE

This investigation required three types of material: a test of adjustment, a deductive test, and a problem solving situation. In that respective order the following were chosen: The Bell Adjustment Inventory, an exercise in formal logic, and a concept-formation type of letter test.

Several factors entered into the selection of an adjustment test. First, the entire study was going to be conducted in a non-clinical setting, thereby eliminating some tests intended primarily for clinical use. Secondly, the subjects were to be tested in groups, not individually. Finally, the tests were not intended to be diagnostic to a fine point, but rather predictions of certain trends.

In a recent dissertation, Cryns<sup>1</sup> has given several reasons for his use of the Bell Adjustment Inventory, and a few of them aptly apply to this smaller study.

a) With few exceptions, the Bell Adjustment Inventory is considered as valid and reliable as any other personality inventory.

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1 Gerd M. Cryns, A Study of the Relationship Between the Problems and Religious Attitudes of College Students, Unpublished Master's Thesis, Loyola University, Chicago, Illinois, 1953.

b) The Bell Adjustment Inventory is of greatest use as a guide of trends toward and symptoms of maladjustment, and as an indicator of degree of group adjustment.

c) It is intended for normal groups, rather than for clinical analysis.

Furthermore, it is self-administering, requiring a minimum of initial directions from the experimenter. With its four general areas of emotional, social, home, and health, it offers a somewhat specific index of adjustment trends.

Admittedly, many criticisms have been leveled at the use of such inventories at all in a psychological setting. Cronbach is certainly well aware of these objections, but he suggests several sane principles which, if followed, may make the use of self-reporting techniques increasingly useful. Two of these principles are applicable to this study.

1. A "poor" score on a personality inventory probably indicates a person who should have further attention; a "good" score does not guarantee the presence of "good" qualities...
3. A self-report test can never be used as a final basis for any decision in counseling or disposing of an individual. It performs its most useful function in suggesting to the psychologist possible facts about the individual to be confirmed by further study of him.<sup>2</sup>

The Bell Adjustment Inventory has been used under the guiding light of these two principles.

Bell gives norms for the four area scores and the total

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2 Lee J. Cronbach, Essentials of Psychological Testing, New York, 1949, 336.

score of the Inventory. The scores obtained fit under five descriptive designations generally ranging from excellent to very unsatisfactory. These designations, i.e., the kind of adjustment indicated by the scores, are not used in this investigation. Interest is centered, rather, in how far one score or mean is above or below another score or mean. The higher the score, the poorer is the adjustment that it indicates. This general interpretation will be followed in the presentation and discussion of the data in Chapter Three. Therefore, although scores or means or cutting points for distribution may fall within the category marked average by Bell, those numerically higher will be interpreted as indicating a trend toward possible need for help and toward poorer adjustment. Those numerically lower will be interpreted as indicating a trend toward good adjustment and probable lack of need for guidance. This interpretation fits both the purpose of this study and the two principles of Cronbach just quoted.

In the selection of the deductive test and the problem solving situation, an attempt was made to select material which would emphasize these functions to the exclusion, as far as possible, of any other pronounced mental abilities. This reaffirms again the reason for rejecting the ordinary IQ test; it involves too much at once and does not isolate at length any one ability.

Syllogisms and causal propositions are recognized expressions of deductive thinking, both in logic and in experimental psychology. Of the several forms, the syllogism, being the most

classical expression, was chosen. For a thesis entitled Some Characteristics of Deductive Thinking,<sup>3</sup> much preliminary testing work was part of the preparation of the final form of a test of thirty syllogisms; this test was selected for the present study. It is composed of thirty items, each of which has a major premise, a minor premise, and a conclusion. The testee is to mark the conclusion as true or false. Five minutes were allowed for this test. A copy of the test and the preliminary instructions are included in appendix.

There are several reasons for the selection of this syllogistic test. First, it was purposely devised to deal with the ordinary functioning of reasoning, thereby following the example set by the adjustment inventory. Second, the various figures and moods used in the test were not picked in a haphazard fashion. Syllogisms were taken only from the first three Figures. Within these Figures, only those moods were retained which have a definite true or false conclusion; no indeterminates were used.<sup>4</sup> This made the scoring more definite by limiting the number of possible answers to two, and relieved the subjects of some unnecessary uncertainty when working the syllogisms. Finally, by using symbols, i.e., letters, rather than concrete terminology,

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<sup>3</sup> Father Charles Eggert, Some Characteristics of Deductive Thinking, Unpublished Doctoral Dissertation, Loyola University, Chicago, Illinois, 1953.

<sup>4</sup> Ibid., 40.



two possibly harmful variables were avoided:

a) the use of concrete terms might constitute more a test of verbal ability and verbal fluency rather than deductive reasoning; and

b) the possibility of a biased conclusion because of the proneness to assent or deny the conclusion not on the basis of the premise, but merely by drawing upon experience and familiarity with the data expressed in the conclusional proposition.<sup>5</sup> The manner of administering the test will be described later.

The field of material from which to choose the problem-solving situation was considerably broader. First of all, the similarity between problem-solving and induction should be noted. Although in the first chapter one of the key words was induction, and now the term problem-solving is being used, nothing fundamentally different to the nature of this study is intended. Many kinds of testing situations are named problem-solving, and a variety of mental activities is employed in their solutions. Thus, some problem-solving situations are expressions of inductive reasoning just as the syllogism is an expression of deductive reasoning. This can be illustrated particularly in experiments on learning and concept formation. The procedure in cue learning and discrimination learning involves the investigation of many particulars until finally something basic or common, like an un-

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<sup>5</sup> Ibid., 29-30.

derlying principle is discerned, which, upon selection, is always accepted as correct. This follows the general pattern of induction given in Chapter One.

The concept-formation type of test offers several phases that can be considered inductive. The many experiments on thought processes in the earlier part of the century concentrated, among other things, on abstraction and generalization. Humphrey defines generalization as "the ability to discern and act upon similarities hidden beneath divergence.... It is, at bottom, the ability to learn from experience."<sup>6</sup> The latter part of that quotation sounds like an advertisement for good adjustment; extremely practical statement on an abstract process. However, the similarities to induction are evident and another definition of generalization may perhaps make the point even clearer.<sup>7</sup>

Generalization may then be said to be the process by which an organism comes to effect a constant modification towards an invariable feature (or set of features) which occurs under varying conditions.<sup>8</sup>

In rather blunt experimental language Woodworth and Schlosberg explains what is meant by the learning and formation of concepts by human subjects.

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6 George Humphrey, Thinking, London, 1951, 307.

7 The fact that these definitions often have important phrases in them describing the action of the one who is generalizing should not be disturbing since they are presented in an experimental setting.

8 Humphrey, Thinking, 265.

Behavior governed by concepts requires that the same response shall be made to objects of the same class, but a different response or no response at all to objects not belonging to that class.<sup>9</sup>

This may not be as close to a definition of induction found in a logic book, but the basic principle is there.

At this point some question may be arising in the minds of those familiar with the scholastic treatment of the intellect. Since abstraction, generalization and concept forming really belong to conception, the first act of the intellect, can they also be considered as expressions of induction, a form of reasoning which is the third act of the intellect? In order to answer this question, it would be well to recall that induction has been defined as a thought process which begins with observation of phenomena and passes to the formulation of laws that explain the facts of sense experience. Conception is the operation by which the intellect abstracts from images of concrete objects and qualities only those features which are absolutely essential to the nature or essence of the object, and therefore common to all objects of the same kind. With these two explanations as a background, Crumley has a fine passage showing the relation of the two.

Considered as a process, then, Induction is of the same nature as Conception. Through Induction as well as through Conception, the intellect grasps the essential qualities of a

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9 Robert S. Woodworth and Harold Schlosberg, Experimental Psychology, New York, 1954, 609.

thing, only in the case of Induction, the qualities, instead of going under the generic name of essential, are more particularly described from the point of view of their causal relations.<sup>10</sup>

In another paragraph he continues this same thought.

Since Conception and Induction are one in nature, they both involve the same processes, namely abstraction and intuition. Moreover, both deal with the same material, that is, objects of sense experience.<sup>11</sup>

He continues to draw like comparisons between the two processes, but these passages are most pertinent to the present discussion. Since, then, induction and conception are of the same nature, a problem-solving situation of the concept-formation type was chosen as the expression of inductive reasoning.

A monograph published by Benjamin Burack in 1950, entitled, "The Nature and Efficiency of Methods of Attack on Reasoning Problems," contains several tests of induction and deduction. From this monograph was selected an inductive problem, largely the concept-formation type devised by Professor Thurstone, containing nineteen items, each of which is made up of five groups of five letters each. Four of the groups have something in common. The subject is to mark the group not having the feature common to the other four groups. The time limit on this test was eleven minutes. A copy of the test and the preliminary instructions and examples are included in the appendix.

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<sup>10</sup> Thomas Crumley, C.S.C., Logic: Deductive and Inductive, New York, 1926, 297.

<sup>11</sup> Ibid., 298.

The subjects employed in this experiment were high school students. Although the school was co-educational, only female subjects were used in order to reduce, if not eliminate, the possible effects which might result from a difference in sex between experimenter and subjects.

Data on two educational levels was desired, so two senior and two freshmen classes attended by girls only were taken over for two days in order to administer the tests just described. This made a total of four separate testing groups. The testing was done in May which meant that the freshmen had almost completed one year of high school and the seniors were ready to graduate. The tests were not given individually but to each small group. The combined freshmen groups totaled eighty-one; the combined senior groups, sixty-four. The IQ's in the freshmen group ranged from 68 to 135; the IQ's in the senior group, from 77 to 124.

In the administration of the test the same instructions were repeated for each of the separate groups. No additional explanation was given beyond the examples presented on the paper, and these examples were taken through with each group before the writing of the test. Every effort was made both to put the students at ease by assuring them that the results of these tests would in no way affect their present scholastic standing, and at the same time to obtain their sincere and honest cooperation.

### CHAPTER III

#### TREATMENT OF THE DATA

The Bell Adjustment Inventory yields four specific scores, one for each of the areas covered, home, health, social, and emotional, and a total score for the entire test. In both the separate area scores and the total score, the higher number indicates a trend toward poorer adjustment and a need for help.

The deductive and inductive tests were scored according to the actual number of items correctly worked within the allotted time. Thus the deductive scores had a possible range of zero to thirty; and the inductive scores, zero to nineteen. Those items omitted, worked incorrectly, or not completed, did not enter at all into the actual score. The scores of the two groups, seniors and freshmen, were never combined for any statistical calculations; each statistic was applied to the scores of each separate group.

The first statistic applied to the scores was the  $X^2$  test, calculated from a frequency count of scores in a 3x3 table. Two  $X^2$ 's, were obtained from frequencies in each of the five adjustment categories: one from adjustment and deduction; the other from adjustment and induction. Table I gives the result of the  $X^2$  test from the ten tables and the corresponding probab-

ities for the senior group. Table II gives the same information for the freshmen group. Except for one figure, the results of the  $X^2$  test are not close to statistical significance. Since, however, all the  $X^2$ 's do not have probabilities of .80 to 1.00, there is only slight indication that certain trends are present.

In the senior group, the highest  $X^2$ , 4.58, was obtained from the combination of scores on the deductive test and on the social test. An examination of the  $3 \times 3$  tables indicates that the higher-than-expected frequencies are on a diagonal from good adjustment and low deductive scores to poor adjustment and high deductive scores. The next highest  $X^2$ , 4.26, comes from inductive and health scores. Here, the indication is less definite but it seems to tend toward the combinations of poor adjustment and low inductive scores, and good adjustment and higher inductive scores. The only other  $X^2$  with less than .60 probability is 2.94, from induction and emotion. Here the larger cells highlight good adjustment and low inductive scores and poorer adjustment and higher inductive scores.

In the freshmen group, six of the ten  $X^2$ 's have a probability of less than .60. The health deduction table yielded the highest  $X^2$ , 8.18, with very pronounced higher-than-expected frequencies in the areas of high deductive and poor adjustment scores and low deductive and better adjustment scores. The next  $X^2$ , 4.04, from health and induction, follows the same line as the preceding one, favoring high inductive and poor adjustment scores and

TABLE I

$\chi^2$  AND APPROXIMATE PROBABILITIES BETWEEN  
TWO TYPES OF REASONING AND FIVE BELL AD-  
JUSTMENT SCORES: SENIOR GROUP

Adjustment Areas	Induction		Deduction	
	$\chi^2$	Probability	$\chi^2$	Probability
Emotional	2.94	.57	1.55	.82
Social	2.32	.67	4.58	.34
Home	1.3	.85	1.57	.82
Health	4.26	.38	2.70	.61
Total	1.82	.77	1.69	.79

lower inductive and better adjustment scores. The next four highest  $\chi^2$ 's, though less definite in indicating trends, show some leaning toward the following combinations:

- a)  $\chi^2$  - 3.97 - Induction-Social - higher induction and poorer adjustment scores
- b)  $\chi^2$  - 3.57 - Deduction-Emotional - lower deductive and poorer adjustment scores
- c)  $\chi^2$  - 3.36 - Induction-Total - higher inductive and poorer adjustment scores and lower inductive and better adjustment scores
- d)  $\chi^2$  - 3.03 - Induction-Emotional - higher inductive and poorer adjustment scores.



TABLE II

$\chi^2$  AND APPROXIMATE PROBABILITIES BETWEEN  
TWO TYPES OF REASONING AND FIVE BELL AD-  
JUSTMENT SCORES: FRESHMEN GROUP

Adjustment Areas	Induction		Deduction	
	$\chi^2$	Probability	$\chi^2$	Probability
Emotional	3.03	.55	3.57	.47
Social	3.97	.42	2.55	.63
Home	2.75	.60	.72	.95
Health	4.04	.41	8.18	.09
Total	3.36	.50	1.69	.79

A comparison of the  $\chi^2$ 's of the two groups, freshmen and seniors, indicates that the seniors, as a group, are more even and stable than the freshmen. They have only two  $\chi^2$ 's above 3.0, while the freshmen have six above 3.0. Here again, the  $\chi^2$  in itself is not statistically significant, but the difference between the two groups is worthy of note. In terms of adjustment areas, there are two in particular in which the freshmen are noticeably higher than the seniors, emotional and health. In only one instance is a freshman  $\chi^2$  definitely lower than that of the senior  $\chi^2$ ; namely, the deduction-social adjustment grouping.

The next statistic applied was the simple calculation of the mean. Since this is an investigation of degree of adjustment

in relation to inductive and deductive ability, the senior and freshmen inductive and deductive scores were each divided into two groups according to the ability indicated by the scores; i.e., a top fifty percent group and a bottom fifty percent group. After this grouping into top and bottom fifty percent in induction and deduction has been made, the five different mean adjustment scores were calculated for each of these eight groups. The adjustment means for the seniors are given in Table III; the adjustment means for the freshmen in Table IV.

TABLE III

MEAN ADJUSTMENT SCORES FOR THE TOP 50% GROUP  
AND BOTTOM 50% GROUP IN THE INDUCTIVE AND  
DEDUCTIVE TESTS: SENIOR GROUP

Groups	Mean Adjustment Scores				
	Emotional	Social	Home	Health	Total
Top 50% Deductive	11.5	11.5	7.0	6.82	36.6
Bottom 50% Deductive	11.77	9.81	8.32	6.44	36.6
Top 50% Inductive	11.98	11.32	7.38	6.88	37.4
Bottom 50% Inductive	11.32	10.	7.94	6.38	35.8

In Table III, it can be readily noted that there are no

strikingly large differences between the means in any of the five adjustment areas. In the deductive groups, the top fifty percent have a higher health and social adjustment mean than the bottom fifty percent. In the emotional and home adjustment areas, the opposite is true. The top and bottom fifty percent have the same total mean adjustment score. In the inductive groupings, the top fifty percent have a higher mean adjustment score than the bottom fifty percent in every area except home adjustment.

TABLE IV

MEAN ADJUSTMENT SCORES FOR THE TOP 50% GROUP  
AND BOTTOM 50% GROUP IN THE INDUCTIVE AND  
DEDUCTIVE TESTS: FRESHMEN GROUP

Groups	Mean Adjustment Scores				
	Emotional	Social	Home	Health	Total
Top 50% Deductive	13.66	10.72	8.3	7.08	39.7
Bottom 50% Deductive	12.28	12.4	7.52	5.86	38.
Top 50% Inductive	13.15	12.19	8.5	7.28	40.45
Bottom 50% Inductive	12.79	11.23	7.82	5.48	37.5

The figures for the freshmen given in Table IV show that in deduction the top fifty percent have a higher mean adjust-

ment score than the bottom fifty percent in every area except social adjustment. In induction, the top fifty percent have a higher mean adjustment score in each adjustment area.

In comparing the two large groups, senior and freshmen, the freshmen, in nine out of ten cases, have a higher mean adjustment score for the top fifty percent groups in deduction and induction. With the seniors, however, in only five out of ten inductive and deductive groups, do the top fifty percent have a higher mean adjustment score than the bottom fifty percent.

The next step was to divide the inductive and deductive groups more sharply according to these two respective abilities. Therefore, the mean adjustment scores were figured for the groups made up of the top and bottom twenty-five percent of the inductive and deductive scores. The senior mean adjustment scores are given in Table V; the freshmen mean adjustment scores, in Table VI.

For the senior groups in both induction and deduction, the top twenty-five percent have a lower mean adjustment score than the bottom twenty-five percent in every area except social adjustment. In this area, the mean adjustment score is higher in both the inductive and deductive groups. The means in adjustment for the top and bottom quarters of the inductive and deductive groups show a more unified trend than the means for the top and bottom fifty percent. In Table III on the fifty percent groups, the top mean is lower than the bottom mean in only three out of ten groups. In Table V on the twenty-five percent groups, the top

mean is lower than the bottom mean in eight out of ten groups. The means of the twenty-five percent groups follow the same direction as the means of the larger fifty percent groups in five out of ten groups; these five are the social and home areas, inductive and deductive, and the emotional adjustment mean for the deductive group.

TABLE V

MEAN ADJUSTMENT SCORES FOR THE TOP 25% GROUP  
AND BOTTOM 25% GROUP IN THE INDUCTIVE AND  
DEDUCTIVE TESTS: SENIOR GROUP

Groups	Mean Adjustment Scores				
	Emotional	Social	Home	Health	Total
Top 25% Deductive	8.88	10.44	5.95	5.88	31.31
Bottom 25% Deductive	10.75	8.69	8.19	6.56	34.19
Top 25% Inductive	10.06	11.31	7.0	6.69	35.06
Bottom 25% Inductive	13.31	9.25	8.94	7.5	39.

The figures for the freshmen given in Table VI show that in the deductive group, the adjustment mean for the top twenty-five percent is lower in three areas, emotional, social and total,

and higher in two areas, home and health, than the bottom twenty-five percent. In the inductive group, the top twenty-five percent has a higher mean adjustment score in four out of five areas, the only exception being the social mean. In contrast to the seniors, the quarter cuttings of the freshmen inductive and deductive groups yield means that departed somewhat from the more unified direction of the means in the fifty percent groups. In the fifty percent groups, nine out of ten of the top fifty percent adjustment means were higher than the bottom half; in the twenty-five percent groups, only six out of ten top quarter means were higher than the bottom quarter means.

TABLE VI

MEAN ADJUSTMENT SCORES FOR THE TOP 25% GROUP  
AND BOTTOM 25% GROUP IN THE INDUCTIVE AND  
DEDUCTIVE TESTS: FRESHMEN GROUP

Groups	Mean Adjustment Scores				
	Emotional	Social	Home	Health	Total
Top 25% Deductive	12.5	9.35	9.1	8.05	39.0
Bottom 25% Deductive	13.15	11.9	8.45	5.65	39.15
Top 25% Inductive	12.85	11.0	9.0	7.3	40.15
Bottom 25% Inductive	11.6	11.45	6.25	5.2	34.5

Now that the differences between the mean adjustment scores have been pointed out, the final step is to test the significance of difference between the means. This difference between means refers to the means of the top and bottom half and quarter of the inductive and deductive groups, not to the difference between senior and freshmen means. The statistic that was selected was White's Rank Test for the significance of difference between two groups. This test is suitable to the data because it can be used without having to make any assumptions about the form of the distributions of the scores; it is a two-tailed test and it should avoid the possible objections that may have been raised if the  $t$  test had been used. Table VII gives the  $T$  or  $T'$  score (whichever is smaller) from White's Rank Test and the accompanying probabilities for the senior fifty percent groups and the senior twenty-five percent groups. Table VIII has the  $T$  or  $T'$  score and the probabilities for the freshmen fifty percent groups and the freshmen twenty-five percent groups. In figuring the probabilities the correction for continuity was included whenever necessary because of the too large numbers in the groups.

The results given in Table VII for the senior group show no probability at the 5% level of confidence, which percent could be accepted as significant. The results for the freshmen in Table VIII show two probabilities lower than the 5% level, .038 in deduction-health for the twenty-five percent group, and .02 in induction-health for the fifty percent group. The second point immedi-

ately apparent in these two tables is that the freshmen have more "significant" probabilities than the senior group.

TABLE VII

T OR T' (WHITE'S RANK TEST) AND PROBABILITIES FOR THE 50% and 25% GROUPS:  
SENIOR

Adjustment Areas	Induction		Deduction	
	T/T' - Top & Bottom 50%	Proba- bility	T/T' - Top & Bottom 50%	Proba- bility
Emotional	906	.097	1016	.771
Social	976	.423	982	.465
Home	1016	.764	969	.378
Health	1029	.896	1028	.888
Total	1012	.726	1037	.976

Adjustment Areas	Induction		Deduction	
	T/T' - Top & Bottom 25%	Proba- bility	T/T' - Top & Bottom 25%	Proba- bility
Emotional	232	.226	257	.810
Social	246	.496	240	.373
Home	244	.459	243	.441
Health	252	.681	250	.624
Total	248	.548	252	.652



TABLE VIII

T OR T' (WHITE'S RANK TEST) AND PROBABILITIES FOR THE 50% AND 25% GROUPS:  
FRESHMEN

Adjustment Areas	Induction		Deduction	
	T/T' - Top & Bottom 50%	Proba- bility	T/T' - Top & Bottom 50%	Proba- bility
Emotional	1696	.96	1575	.242
Social	1626	.484	1587	.289
Home	1694	.944	1654	.66
Health	1452	.02	1545	.147
Total	1601	.252	1643	.589

Adjustment Areas	Induction		Deduction	
	T/T' - Top & Bottom 25%	Proba- bility	T/T' - Top & Bottom 25%	Proba- bility
Emotional	388	.562	398	.75
Social	406	.92	354	.14
Home	360	.177	403	.86
Health	344	.075	332	.038
Total	366	.238	410	.000

The results of the  $X^2$  test and White's Rank Test show that there is very little to be said which carries any statistical

significance in reference to the purpose of this investigation. Nevertheless, there remains something to be said for the trends indicated by the results of this work.

In order to get a picture of the material now to be discussed, Table IX for the seniors and Table X for the freshmen give the top fifty percent and top twenty-five percent adjustment means that are higher, equal, and lower than the bottom means in the same areas in order of their significance according to probabilities. In studying these two tables, it should be recalled that the numerically higher adjustment score or mean is to be interpreted as indicating a trend toward possibly poorer adjustment and a need for help; and the lower adjustment mean, as indicating a trend for better adjustment and a possible lack of need for guidance. Secondly, the tables list the top fifty and twenty-five percent means which are the means of those groups showing higher inductive and deductive abilities.

With these reminders as to interpretation, the following pertinent statements can be made regarding the data, always bearing in mind that these indicate only trends, and not conclusions shown to be statistically significant. For the seniors in the top fifty percent groups,

a) those with higher deductive ability show poorer social and health adjustment, and better home and emotional adjustment;

b) those with higher inductive ability show poorer

emotional, social, total, and health adjustment, and better home adjustment.

For the seniors in the top twenty-five percent groups,

c) those with higher deductive ability show poorer social adjustment and better home, health, total, and emotional adjustment;

d) those with higher inductive ability show poorer social adjustment, and better emotional, home, total, and health adjustment.

TABLE IX

SUMMARIZATION: SENIORS  
(Probabilities from White's Rank Test)

Top 50% Adjustment Mean Is:

Higher (poorer adj.)	Equal	Lower (better adj.)
Emot - Induc - .097	Total-Deduc - .976	Home-Deduc - .378
Social-Induc - .423		Home-Induc - .764
Social-Deduc - .465		Emot-Deduc - .771
Total - Induc - .726		
Health-Deduc - .888		
Health-Induc - .896		

Top 25% Adjustment Mean Is:

Social-Deduc - .373	Emot - Induc - .226
Social-Induc - .496	Home - Deduc - .441
	Home - Induc - .459
	Total - Induc - .548
	Health-Deduc - .624
	Total - Deduc - .652
	Health-Induc - .681
	Emot - Deduc - .810

TABLE X

SUMMARIZATION: FRESHMEN  
(Probabilities from White's Rank Test)

Top 50% Adjustment Mean Is:

Higher  
(poorer adj.)

Lower  
(better adj.)

Health-Induc - .02  
Health-Deduc - .147  
Emot - Deduc - .242  
Total- Induc - .252  
Social-Induc - .484  
Total- Deduc - .589  
Home - Deduc - .66  
Home - Induc - .944  
Emot - Induc - .96

Social-Deduc - .289

Top 25% Adjustment Mean Is:

Health-Deduc - .038  
Health-Induc - .075  
Home - Induc - .177  
Total- Induc - .238  
Emot - Induc - .562  
Home - Deduc - .86

Social-Deduc - .14  
Emot - Deduc - .75  
Social-Induc - .92  
Total- Deduc - .000

For the freshmen in the top fifty percent groups,

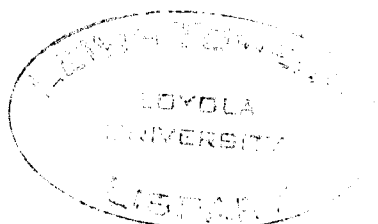
a) those with higher deductive ability show poorer health, emotional, total, and home adjustment, and better social adjustment;

b) those with higher inductive ability show poorer health, total, social, home, and emotional adjustment.

For the freshmen in the top twenty-five percent groups,

c) those with higher deductive ability show poorer health and home adjustment, and better social, emotional, and total adjustment;

d) those with higher inductive ability show poorer health, home, total, and emotional adjustment, and better social adjustment.



## CHAPTER IV

### CONCLUSION

This experiment has investigated the relationship between skill in deductive reasoning and adjustment, and between problem solving and adjustment at two different levels of education. In the form of definite conclusions, little can be said. The value of the work lies, rather, in the tendencies in one direction or another highlighted by the statistical figures, and the possibilities for additional needed investigation in this and related areas of experimentation.

A summary of the general findings can be stated as follows. For the seniors,

- a) the top and bottom twenty-five percent grouping favors the trend that the better inductive and deductive ability goes with better adjustment;

- b) the larger fifty percent grouping seems to indicate a more equal, or even opposite trend.

For the freshmen,

- a) the larger fifty percent groups almost entirely combine higher inductive and deductive ability with poorer adjustment;

- b) in the twenty-five percent groups, higher inductive

and deductive ability is paired with poorer adjustment in six out of ten cases;

c) also, in the twenty-five percent groups, three of the only four cases indicating better adjustment combine higher deductive ability with some adjustment area.

As to specific adjustment areas the following trends seem more pronounced than others. For the seniors,

a) higher inductive and deductive ability went with poorer social adjustment;

b) higher inductive and deductive ability went with better home adjustment.

For the freshmen,

a) higher inductive and deductive ability accompanied poorer health adjustment and poorer home adjustment;

b) higher inductive ability combined with poorer total adjustment;

c) higher deductive ability went with better social adjustment.

It seems that this investigation shows deficiencies precisely in those points which, if worked on, would not only improve this work but lead to a more thorough and expanded study of the entire question. A larger battery of tests, recognized and accepted as vehicles of inductive and deductive ability, would give a better indication of the subjects' capabilities in these two forms of reasoning. Perhaps this point would require the most

work, as it would involve a sifting, devising and correlating of different tests in an attempt to identify those which seem to test the same ability.

More than one adjustment test might also be of benefit, if suitable ones were available that were not primarily devised and intended for clinical use or abnormal cases. Administration of tests to much smaller groups might also contribute to the accuracy of the results.

One final point remains which could constitute one of the chief failures of this study. In the first chapter some attempt was made to give a working definition of adjustment. It was never intended to be definitive, but the points mentioned did seem to be necessary as far as the definition went. Adjustment was defined as the establishment and maintenance of the proper order between the individual person and reality, composed of himself, the animate and inanimate environment, and God. Many adjustment inventories or questionnaires, such as the Bell Adjustment Inventory, make definite efforts to cover that part of reality "composed of himself and the environment," e.g., Bell's health and emotional areas for the former, and his home and social areas for the latter, with certain overlapping taken for granted. It is the third element in reality, God, which seems neglected particularly in a Catholic setting and no less in a non-Catholic setting (allowing for any change in terminology for the word God that might be necessary). It does not seem that this point can be either ignored



or assumed to be included in any investigation involving adjustment, as was the case in the experiment just described. Perhaps such an attitude would renew the whole question of the validity of inventories to measure adjustment, or it would demand a new approach to adjustment in terms of the whole reality within which man exists and comes into contact.

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APPENDIX A

SPECIMEN: DEDUCTIVE TEST

Directions:

You will be given a number of short paragraphs similar to the examples shown below. Each paragraph consists of two statements and a conclusion. The truth of the conclusion depends upon the first two statements. Your problem is to decide whether the conclusion is true or false.

Example:                      Every C is B.  
                                Every A is C.  
                                Therefore, every A is B.

In the above example, the conclusion that every A is B is true, for it follows from the first two statements.

Another example:              Every C is B.  
                                Every A is C.  
                                Therefore, some A is not B.

In this example, the conclusion is false, for it does not follow from the preceding statements.

Mark your answers on the answer sheet. If you think the conclusion is true, mark it with the letter T. If you think the conclusion is false, mark it with the letter F.

Answer each one carefully. Be sure not to skip any. Work as rapidly as you can without making mistakes.

DO NOT BEGIN THE TEST UNTIL THE SIGNAL IS GIVEN.

1. Every C is B.  
Every A is C.  
Therefore, no A is B.
2. No B is C.  
Some A is C.  
Therefore, some A is not B.
3. No C is B.  
Some C is A.  
Therefore, every A is B.
4. Every B is C.  
Some A is not C.  
Therefore, some A is not B.
5. No B is C.  
Some A is C.  
Therefore, every A is B.
6. No C is B.  
Some A is C.  
Therefore, no A is B.
7. No B is C.  
Every A is C.  
Therefore, no A is B.
8. Every C is B.  
Every A is C.  
Therefore, some A is B.
9. No C is B.  
Every C is A.  
Therefore, every A is B.
10. No C is B.  
Some A is C.  
Therefore, every A is B.
11. Every B is C.  
Some A is not C.  
Therefore, every A is B.
12. No C is B.  
Some C is A.  
Therefore, some A is not B.
13. Some C is not B.  
Every C is A.  
Therefore, some A is not B.
14. Every C is B.  
Some A is C.  
Therefore, no A is B.
15. Every C is B.  
Some C is A.  
Therefore, some A is B.
16. Every C is B.  
Some C is A.  
Therefore, no A is B.
17. Some C is B.  
Every C is A.  
Therefore, some A is B.
18. Every B is C.  
No A is C.  
Therefore, some A is B.
19. No C is B.  
Every A is C.  
Therefore, some A is not B.
20. No C is B.  
Every C is A.  
Therefore, some A is not B.
21. Every C is B.  
Some A is C.  
Therefore, some A is B.
22. No C is B.  
Every A is C.  
Therefore, some A is B.
23. Every B is C.  
No A is C.  
Therefore, no A is B.
24. Every C is B.  
Every C is A.  
Therefore, some A is B.

- |   |   |
|---|---|
| 25.       Some C is B.<br>Every C is A.<br>Therefore, no A is B.        | 28.       No B is C.<br>Every A is C.<br>Therefore, some A is B.  |
| 26.       Some C is not B.<br>Every C is A.<br>Therefore, every A is B. | 29.       No C is B.<br>Every A is C.<br>Therefore, every A is B. |
| 27.       Every C is B.<br>Every C is A.<br>Therefore, no A is B.       | 30.       No C is B.<br>Every A is C.<br>Therefore, no A is B.    |
- 

## APPENDIX B

## SPECIMEN: INDUCTIVE TEST

## Directions:

In the five groups of letters below, notice that four of the groups have something in common. The one which is not like the others has been marked.

YLNPJ        XPBCR        YNTFH        YRGSW        YHDLY

Four of the groups begin with the letter Y. The one which does not begin with Y is marked. Look at the next problem.

AAXVP        FNTBB        HQTQX        JDSWR        MECTE

Four of the groups have a repeated letter. The first, second, third, and fifth groups have the letters AA, BB, QQ, and EE respectively. The fourth group does not have a repeated letter. It is unlike the other groups so it is marked.

Work the next two problems. Put a mark under the group which is different in each case.

ABCDE	XYZPS	EFGHI	CXVTN	PJKLM
EDCBA	VWXYZ	IHGFE	JKLMN	SBTCK

In the first problem four of the groups have letters occurring in alphabetical order. You should have put a mark under the fourth group.

In the second problem four of the groups are in alphabetical order, left to right, or right to left. The fifth group should be marked.

Look at the next two problems. Try to find which one should be marked.

BDHQX	SDAPZ	GXMOT	LEZTQ	NXUFS
KCUPE	FZEGO	UMBXA	APIQT	LNUKH

In the first problem four of the groups each contain a vowel. The first group should be marked. In the second problem four of the groups have two vowels. Group five should be marked.

Work the problems which follow:

- |     |       |       |       |       |       |
|-----|-------|-------|-------|-------|-------|
| 1.  | VBCDF | WQRSH | XIJKF | YLMNF | ZABCF |
| 2.  | ELMNE | FABCF | GOPQG | HZTMH | IVWXI |
| 3.  | LGBGM | TBKAK | ZDNEN | FRLIC | VPSPW |
| 4.  | XVTQZ | BFDHJ | HDFBJ | JBFDH | HJFBD |
| 5.  | BCAHV | BCOHV | DZELM | DKILM | DTCLM |
| 6.  | FCRCT | CJCCL | CPCSC | CCRCQ | CKCFC |
| 7.  | BWBRB | BBCBS | RBMBB | BNBBV | XBBZB |
| 8.  | BQHTM | AUIEO | ZDKRN | TMPZB | HXKQN |
| 9.  | EFGHI | EDCBA | UTSRQ | ALRXI | OPQRS |
| 10. | CEDGH | FAGHB | DKCES | LMCED | MPCEK |
| 11. | CFAGG | PESRP | VROVF | NOMSN | PROTS |
| 12. | ONMLK | LKJIH | UTSRQ | GKMOQ | HGFED |
| 13. | ALMNA | PBCDP | EVRHE | UJKLU | IDVLI |
| 14. | CCPPR | MSSMR | TRRTR | JNNJR | WWDDR |
| 15. | BSQVM | TDPDX | GHGRG | FPSFR | MPMBM |
| 16. | ACTRM | ABSPQ | CDTGH | PQBXY | MNCST |



17.	JKLMV	BPQRS	KNWXY	BCDQT	CXTRF
18.	FGHLM	CDFGH	JKLMNO	STVWX	PQSTU
19.	VMSAT	DGMSB	SPLOM	QTMSC	MDSHP

APPROVAL SHEET

The thesis submitted by Sister M. Rosaire Lucassen, O.P. has been read and approved by three members of the Department of Psychology.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the degree of Master of Arts.

Jan' 1959  
Date

Vincent V. Herby  
Signature of Adviser