AN EVALUATION OF A DIFFERENTIAL EDUCATION PROGRAM FOR ABLE AND GIFTED HIGH SCHOOL STUDENTS IN SOUTHWESTERN OREGON

The purpose of this investigation was to evaluate the effects of a six week residential summer program of differential education for gifted high school students. It was designed to determine the extent to which participants in the program were proficient in aspects of critical and creative thinking, and in the ability to maintain an open mind and adjust to the stress imposed by constant environmental change.

One hundred eight-five scholars from a parent population of 547 who met the selection requirements for the program participated in the project. Two hundred and fifty students from the parent population were selected to serve as a control group of Promethean Alternates who did not participate in the project.

Participants, referred to as Promethean Scholars, took part in an intensive, interwoven matrix of experiences involving
interdisciplinary classes of timely significance, small group seminars on topics concerning conflicts in American culture, lecture-demonstrations and addresses from prominent national figures keyed to seminar topics, and a tremendous diversity of evening cultural experiences and weekend field experiences.

Promethean Scholars and Promethean Alternates were tested prior to initiation of the program to establish covariance controls for intelligence and academic ability. Final testing was conducted at the end of the project, with an additional evaluation by means of a teacher questionnaire administered one academic year after the termination of the project.

Data used in this study were obtained from four tests. They were: *Watson-Glaser Critical Thinking Appraisal, Form YM*, *Torrance Tests of Creative Thinking, Form A*, *Dogmatism Scale, Form E*, *Test of Behavioral Rigidity*.

The following conclusions were drawn from the data analyzed in this investigation.

1. Critical thinking abilities of Promethean Scholars were significantly greater (.01) than those of Promethean Alternates.

2. Creative thinking abilities of Promethean Scholars were not significantly greater than those of Promethean Alternates.

3. Promethean Scholars were significantly less dogmatic (.01) than Promethean Alternates.
4. Promethean Scholars exhibited significantly less behavioral rigidity (.01) than Promethean Alternates.

5. On the basis of a questionnaire administered one year after participation, Promethean Scholars exhibited significantly greater critical thinking abilities (.01), creative thinking abilities (.01), love of learning (.05), and tolerance of ambiguity (.05) than did Promethean Alternates. No significant difference was noted in understanding of self, social conscience, leadership, quantity and quality of production, or response to challenge.

6. Evidence was obtained to indicate that it is possible to make significant changes in complex behavioral criteria in an intensive interdisciplinary program of differential education during a six week period.

7. Evidence was obtained to indicate that it is possible to get the cooperation and the necessary resources of many schools and agencies within a region in order to provide a differential education program for gifted high school students.
An Evaluation of a Differential Education Program
for Able and Gifted High School Students
in Southwestern Oregon

by

Ronald Deane Lamb

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I. INTRODUCTION

During the past fifty years, interest in providing differential education for gifted children has been somewhat sporadic. Early studies by Lewis Terman and Leta Hollingsworth concerned primarily with identification, gave rise to widespread, but short-lived interest. Following a period of egalitarianism during the 1930s and 1940s interest was renewed and heightened by the vast changes that began to take place following World War II. This increased interest was reflected by the Educational Policies Commission, in a publication entitled, The Central Purpose of American Education (21, p. 1), wherein it was stated that:

The basic American value, respect for the individual, has led to one of the major charges which the American people have placed on their schools: to foster that development of individual capacities which will enable each human being to become the best person he is capable of becoming.

The importance of this philosophy in regards to gifted children has been emphasized by the Carnegie Foundation for the Advancement of Teaching, which stated that (5, p. 3):

A basic aim of our society is to help each individual to fulfill the promise that is in him. Our educational system is the chief instrument of achieving that goal. To achieve it, the schools must recognize that children differ in their abilities and provide programs designed to develop the potentialities of children at each level. Thus special
programs for the academically talented student are not a special privilege; they are a consequence of our commitment to provide every American youngster with educational opportunities suited to his level of ability.

Awareness of the need for special provisions for the gifted has in the past few years been noted by many leaders in education and national affairs, and has led to increased efforts to systematically identify and locate young people of exceptional promise. While the location and identification of gifted young people is the first step in providing educational opportunities suited to their abilities, the second step is, as has been stated by Hildreth (47, p. 6): "... to provide differential education programs to develop their full potential."

Currently, many well intentioned schools cannot implement meaningful programs for gifted individuals within the normal curriculum due to lack of adequate teaching staff and facilities. Consequently, special programs have evolved to meet the specific needs of gifted students.

Gallagher (33), Kough (55), Hildreth (47), Henry (44), Bereday (2), Witty (97), Everett (26), and Havighurst (42), cite the many different provisions for programs of differential education for gifted pupils. Included are classroom enrichment, honors classes, cluster grouping within schools, acceleration, advanced courses, advanced placement, college courses, special interest groups, seminars,
counseling, additional loads, summer courses, Saturday and evening classes, and entire schools devoted to gifted pupils.

Many of these programs are truly innovative in nature, and as such are difficult to evaluate by traditional standards. It is necessary, however, to assess the effectiveness of these programs to determine the extent to which the innovations have been successful in achieving their objectives.

Statement of the Problem

The purpose of this study was to evaluate the effectiveness of a six week residential summer school for able and gifted high school students from the seven southwestern counties of the State of Oregon. This program, entitled Project Prometheus, had the following major objectives:

1. To operate an exemplary, culturally oriented summer school program for able secondary school students from the public and private high schools of southern Oregon.

2. To provide unique cultural and intellectual experiences normally unavailable for such students during the regular school year.

3. To demonstrate how regional, cultural and educational resources can be mobilized to implement qualitative educational improvement of high school academic programs.
4. To operate innovative inter-disciplinary classes of timely significance.

5. To intensify the student's awareness of the tentative nature of his conclusions and increase his ability to adjust to change.

6. To increase the student's ability to process information critically.

7. To create an educational environment that is conducive to creative thinking.

8. To extend the student's involvement in intellectual and cultural activities.

Effective attainment of the first four objectives was insured by the fact that if the program was completed, they would have been realized. Objectives five through seven were the concern of this study. Objective eight is part of a longitudinal assessment and is not of primary concern in this study. Answers were sought to the following specific questions:

1. To what extent are Promethean Scholars aware of the tentative nature of their conclusions as measured by Rokeach's Dogmatism Scale?

2. To what extent are Promethean Scholars able to adjust to the stress imposed upon them by constant environmental
changes as measured by Schaie's Test of Behavioral Rigidity?

3. To what extent are Promethean Scholars able to process information critically as measured by the Watson-Glaser Critical Thinking Appraisal?

4. To what extent are Promethean Scholars proficient in creative thinking as measured by the Torrance Tests of Creative Thinking?

5. To what extent do Promethean Scholars differ from Promethean Alternates in their awareness of the tentative nature of their conclusions?

6. To what extent do Promethean Scholars differ from Promethean Alternates in ability to adjust to stress imposed upon them by environmental changes?

7. To what extent do Promethean Scholars differ from Promethean Alternates in ability to process information critically?

8. To what extent do Promethean Scholars differ from Promethean Alternates in ability to think creatively?

9. To what extent do Promethean Scholars differ from Promethean Alternates in selected areas of educational development twelve months after the termination of the project as measured by a questionnaire sent to their schools?
This study was designed to investigate the above questions based on the assumption that in a dynamic world faced with exploding populations and increasingly complex problems there is a critical need for leaders and a general citizenry who possess critical and inquiring minds and can explore creative new ideas for the solution of problems. It is further assumed that able and gifted individuals have a unique capacity to engage in intellectual activities of this nature.

Hypotheses to be Tested

The investigator's major hypothesis was based upon the assumption that complex educational objectives are best achieved when the entire educational program is geared to providing experiences for students that create an environmental climate conducive to the development of these objectives. It was further hypothesized that a concentrated experience may have more impact on individuals than several less powerful experiences spread out over a more lengthy period.

To test these hypotheses, the following four null hypotheses were proposed:

1. There is no difference in critical thinking ability between able students who have participated in Project Prometheus and able students who have not participated.

2. There is no difference in creative thinking ability between
able students who have participated in Project Prometheus and able students who have not participated.

3. There is no difference in behavioral rigidity between able students who have participated in Project Prometheus and able students who have not participated.

4. There is no difference in dogmatism between able students who have participated in Project Prometheus and able students who have not participated.

To determine if the effects of Project Prometheus upon the participants were transitory or more protracted, the following null hypothesis was proposed:

5. There is no difference in the nine abilities measured by the teacher evaluation form between able students who have participated in Project Prometheus and able students who have not participated as measured one academic year after the termination of the project.

For the purposes of analysis hypothesis number five was divided into the following nine sub-hypotheses.

5a. There is no difference in critical thinking between able students who have participated in Project Prometheus and able students who have not participated based upon teacher evaluations one year after termination of the project.
5b. There is no difference in creative thinking between able students who have participated in Project Prometheus and able students who have not participated based upon teacher evaluations one year after termination of the project.

5c. There is no difference in understanding of self between able students who have participated in Project Prometheus and able students who have not participated based upon teacher evaluations one year after termination of the project.

5d. There is no difference in love of learning between able students who have participated in Project Prometheus and able students who have not participated based upon teacher evaluations one year after termination of the project.

5e. There is no difference in social conscience between able students who have participated in Project Prometheus and able students who have not participated based upon teacher evaluations one year after termination of the project.

5f. There is no difference in tolerance of ambiguity between able students who have participated in Project Prometheus and able students who have not participated
based upon teacher evaluations one year after termination of the project.

5g. There is no difference in leadership between able students who have participated in Project Prometheus and able students who have not participated based upon teacher evaluations one year after termination of the project.

5h. There is no difference in quantity and quality of production between able students who have participated in Project Prometheus and able students who have not participated based upon teacher evaluations one year after termination of the project.

5i. There is no difference in response to challenge between able students who have participated in Project Prometheus and able students who have not participated based upon teacher evaluations one year after termination of the project.

Definition of Terms

Project Prometheus

Project Prometheus was a six week residential summer high school for able and gifted high school students from the seven southwestern Oregon counties operating under a three year contract from

Promethean Scholars

Promethean Scholars are defined as those students from the seven southwestern Oregon counties who participated in Project Prometheus.

Promethean Alternates

Promethean Alternates are defined as those students from the seven southwestern Oregon counties who met the selection requirements to participate in Project Prometheus but were not selected to attend or were unable to attend due to other factors.

Able and Gifted Students

Witty (97, p. 55), defines able and gifted students as those children whose performance, in a valuable line of human activity, is consistently or repeatedly remarkable. Gallagher (35), and Hildreth (47), give various definitions based primarily upon scores on standardized I.Q. and Achievement Tests. The term able and gifted students, as used in this study, refers to students who have met the preliminary selection requirements for participation in Project Prometheus. These requirements are two fold: an I.Q. of 120 or above based upon a nationally standardized intelligence test, and a
score that ranks above the 95th percentile on a nationally standardized achievement test.

The Seven Southwestern Oregon Counties

The seven southwestern Oregon counties are Douglas, Coos, Curry, Josephine, Jackson, Klamath and Lake.

Critical Thinking

Critical thinking is defined by Good (39, p. 424) as thinking that proceeds on the basis of careful evaluation of premises and evidence and comes to conclusions with caution through the consideration of all pertinent factors. The authors of the critical thinking test used in this study defined critical thinking as a composite of attitudes, knowledge, and skills which include (97, p. 10):

1. Attitudes of inquiry that involve an ability to recognize the existence of problems or an acceptance of the general need for evidence in support of what is asserted to be true.

2. Knowledge of the nature of valid inferences, distractions, and generalizations in which the weight of accuracy of different levels of evidence are logically determined.

3. Skills in employing and applying the above attitudes and knowledge.

As used in this study, critical thinking refers to proficiency in this composite of abilities.
Creative Thinking

Torrance (91, p. 633) defines creative thinking as:

The process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, dis-harmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about the deficiencies; testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results.

This concept of creative thinking has been reflected in the types of tasks incorporated into the battery of tests used in this study.

Activities were developed to measure the constellation of factors described by Guilford (41, p. 277) as divergent thinking abilities.

Specifically, these factors are as follows:

1. **Fluency**: the quantity of ideas generated.
2. **Flexibility**: the number of shifts in approach or changes in direction or thinking.
3. **Originality**: the statistical infrequency of ideas produced, as the extent to which the response represents a new approach.
4. **Elaboration**: the amount of detail, specificity, or embellishment manifested.

Creative thinking, as used in this study, refers to proficiency in these four abilities.

Dogmatism

Dogmatism is defined as the inability to evaluate information on its own merit regardless of the source of information or its agreement
or disagreement with the individual's total system of beliefs. Rokeach (75, p. 183) defines dogmatic thinking as a total cognitive configuration of ideas and beliefs organized into a relatively closed system and emphasizes that a dogmatic or closed-minded individual is characterized by an authoritarian outlook on life, intolerance towards those with opposing beliefs, and sufferance of those with similar beliefs.

The evaluation instrument used in this study was designed to measure a total state of mind, characterized on the dogmatic or closed-minded side by (75, p. 286):

1. An unwillingness to relinquish old belief systems.
2. An unwillingness to test and examine new belief systems.
3. The inability to synthesize new material into an integrated whole.

Behavioral Rigidity

Behavioral rigidity is defined as the inability of the individual to adjust to the stress imposed upon him by constant environmental change. The author of the instrument used in this study defines rigid behavior as (82, p. 608):

A tendency to perseverate and resist conceptual change, to resist the acquisition of new patterns of behavior, and to refuse to relinquish old and established patterns.

More specifically, Schaie (80, p. 11) recognizes three dimensions of behavioral rigidity:

1. Psychomotor speed; the individuals rate of emission of familiar cognitive responses.
2. Personality - perceptual rigidity; the individual's ability to adjust readily to new surroundings and change in cognitive and environmental patterns.

3. Motor-cognitive rigidity; the individual's ability to adjust to shifts in familiar patterns and to continuously changing situational demands.

Behavioral rigidity as used in this study, refers to student proficiency in a composite of these three abilities.

**Academic Achievement**

Academic achievement is defined as the extent to which the student has mastered the subject matter presented in the various courses in school and is measured by scores on standardized achievement tests administered by the high schools in the region.

**Academic Ability**

Academic ability is defined as the student's capacity to perform academic tasks and is measured by his scores on the School and College Ability Test.

**Response to Challenge**

Response to challenge is defined as a student's willingness to perform difficult tasks, to persevere in problem situations, and to gear his response to the challenge itself rather than what he thinks is expected.
Understanding of Self

Understanding of self is defined as the student's ability to estimate and accept his own strengths and weaknesses realistically, and to feel a sense of personal worth.

Love of Learning

Love of learning refers to the value that the student places upon learning and the "need to know" as opposed to learning for the purpose of obtaining high grades in school.

Social Conscience

Social conscience is defined as the respect and regard that the student has for the feelings, and needs of others regardless of their status, color, creed, or intellectual capabilities.

Tolerance of Ambiguity

By tolerance of ambiguity is meant the student's flexibility in handling problems that may not have "right" or "wrong" answers, and his willingness to consider more than one solution to a problem.

Leadership

Leadership is defined as the student's willingness to accept and carryout the responsibilities of leadership roles in his school.

Quantity and Quality of Production

Quantity and quality of production is defined as the intellectual productivity of the student in terms of his capabilities.
Basic Assumptions

In this study it was assumed that:

1. The Torrance Tests of Creative Thinking validly and reliably measure aspects of creative thinking.


3. The Test of Behavioral Rigidity validly and reliably measures certain mental processes which are closely connected with the ability to adjust to change.

4. Rokeach's Dogmatism Scale validly and reliably measures degrees of open and closed-mindedness.

5. The Culture-Fair Intelligence Test validly and reliably measures general mental ability.

6. The School and College Ability Test validly and reliably measures general academic ability.

7. Maturational changes and the effect of unplanned contemporaneous events are assumed to be approximately equal in both the experimental and the control group.

8. Complex educational objectives can be analyzed into a number of components for the purpose of evaluation.

9. Teachers in the seven southwestern Oregon counties can effectively evaluate their students on the criteria of concern
in this study.

10. Screening procedures at the various high school prior to
collection of participants were adequate to meet the objectives
set forth in the program.

Limitations of the Study

The investigations reported in this study were subject to the
following limitations:

1. The problem was limited to able and gifted students from
the high schools in the seven southwestern Oregon counties.

2. The study was further limited to selected sophomores and
juniors for the academic year 1966–67.

3. The study was concerned with the following population
criteria:
   a. Those students who met selection criteria of
      intelligence and academic achievement,
   b. Those students who made formal application to
      participate in the program.

4. The study was further limited to the operation of Project
Prometheus during the six week session in the summer of
1967.

5. The sampling procedures were dependent upon the procedures
set up for the selection of participants in the program.
6. Preliminary screening procedures for eligibility to participate in the program came from school records.

7. Critical thinking, open-mindedness, flexibility, and creative thinking abilities of individuals in this study may be influenced by past and present learning situations both academic and non-academic, which are not being considered in this study.

8. Critical thinking ability, flexibility, open-mindedness, and creative thinking ability as measured by the instruments used are the only factors of concern in this study.

Importance of the Study

In the Outline and Summary of Report on Mentally Gifted Minor Programs, 1966, prepared for the California Legislature Assembly Committee on Education (72, p. 5), Joseph P. Rice stated in reference to education of the gifted that:

American education has traditionally been dedicated to the full intellectual development of every student in keeping with his natural endowment. Taken to its extreme expression egalitarianism frequently results in the deliberate handicapping of the bright and talented by denying them advanced materials and instruction in order to maintain an artificial and superimposed 'equality' in the classroom.

The need for an action program to provide differential education for gifted students in Oregon was highlighted in an address by Governor Tom McCall to the Oregon Superintendents Conference in
January of 1967 (63). He stated that educators:

... must begin to use a multitude of resources outside the formal school environment to foster development of skills, values, attitudes, and competence in such important matters as self-government, job-training, cultural and social pursuits. These most vital areas of human concern have too long been neglected by our secondary schools because of restrictions imposed by the nature and structure of their curricula.

Very often programs for gifted students are provided by large urban communities with ample resources. However, it is important that the very special needs of students living in rural areas not be overlooked. Typically, rural youngsters find themselves in areas well endowed with natural surroundings but isolated from cultural pursuits, library facilities and other embellishments associated with large urban centers. Rural isolation restricts gifted students further since they are often sparsely distributed and it is difficult to form special classes or even groups within regular classroom situations.

Plowman (70, p. 4) states that when you find a gifted child in a rural or low density populated area he may be:

1. isolated: from intellectual stimulation and from learning resources;
2. unsophisticated: uninformed, lacking in social and learning skills, and provincial;
3. deprived: culturally and educationally.

These conditions are not conducive to the maximum development of the gifted child's full potential. For as Plowman states (70, p. 4):
Gifted children need access to persons, experiences relationships, materials, and ideas for extending awareness. They need books, records, learning kits, laboratory equipment, data manipulation devices. They need to be introduced to persons who can meet them in a human-being-to-human-being encounter, are especially knowledgeable, possess constructive discontent, tend to play with ideas, and who create new ideas and other products as a result of their own sensitivity to problems, flexibility, fluency and originality.

It is evident that as matters now stand, the vast majority of rural schools are too small to provide necessary intellectual stimulation, enrichment or sufficient elective courses for the gifted. Consequently, gifted children from rural areas suffer in comparison with children of similar endowment who live in urban centers.

In a report submitted by the Governor's Coordinating Committee on the Economic Opportunities Act in April 1965, entitled, *A Demographic Analysis of the State of Oregon* (68) it is shown that the seven southwestern Oregon counties clearly suffer from the effects of rural isolation.

At the time of the study, the region embraced an area of 26,980 square miles and contained a population estimated at 312,819 (State Board of Census, July 1, 1964). Population density was only 11.5 people to the square mile as apposed to a figure of 70.6 per square mile for the entire State of Oregon. In addition, the area contained only three cities which exceeded 10,000 in population (Medford, Klamath Falls, and Roseburg), and none with a population greater than 27,000.
The study initiated by the Governor's Committee was aimed to detect those areas and people in the state of Oregon who were suffering from social and cultural conditions marked by poverty. The committee's findings indicated that three of the seven counties (Jackson, Douglas and Coos) are numbered among the most needy on every poverty index used by the investigators. Klamath County was numbered among the top ten most needy counties on four of the nine indexes used, and Josephine County was among the top ten as far as high school dropouts were concerned.

The schools of the project area do not have sufficient financial resources to operate a program of the magnitude of Project Prometheus without substantial financing from other sources. Consequently, the program was submitted under Title III of the Elementary and Secondary Education Act of 1965, (P. L. 89-10) and subsequently funded for 1966. Following successful completion of the first summer program the project received additional funding to operate during the summer of 1967 and 1968.

The necessity of evaluating a program that has been funded by the federal government for a sum in excess of $320,000 is quite apparent to most tax payers. Less apparent but equally important is the necessity of evaluating the theory that underlies the structure of Project Prometheus: that complex educational objectives, such as critical thinking and creative thinking, may better be attained when
the structure of an entire educational program provides the student with an opportunity to develop and to use these abilities in all areas of knowledge.

In reference to this theory, The Committee of College and University Examiners (13, p. 77) states that:

Chausow (1955), Dressel and Mayhew (1954), Bloom (1954) and others have made clear that the achievement of complex types of critical thinking objectives are not likely to be attained by a simple lecture method or by merely telling the students what they are to do or how they are to do it. Demonstrations of appropriate problem-solving processes are not very effective in bringing about actual problem-solving competence. . . . only small gains are attained in critical thinking when merely a single course in a college program aims to develop this type of competence. On the other hand, when the entire curriculum is devoted to this same purpose (i.e., when these objectives become the theme that plays through a large number of courses) the student's gains in critical thinking become very large. In effect, the entire educational environment must be tuned towards the achievement of complex objectives if they are to be attained in any significant way.

Lending support to this theory and to the administrative set up of Project Prometheus is a study reported by Stern (31, p. 430) in which it was found:

. . . that schools which go furthest to reduce authoritarian attitudes and increasing critical thinking, . . . have peculiar characteristics which help to maximize their focus on the student:

1. They are residential;
2. They are based in integrated general education programs with full administrative support;
3. They give primary emphasis to the intellectual growth of the students.
Many studies have been reported in which individual objectives have been made the focus of a particular class. However, the members of the Committee of College and University Examiners (13, p. 88) report that:

Maslow (1959) has suggested that peak experience may have a powerful influence on major changes in the individual. The hypothesis arising out of Maslow's work is that a single powerful experience may have much more impact on the individual than many less powerful experiences.

In summarizing their exposition on attainment of complex objectives Krathwohl, Bloom and Masia (13, p. 84) state that:

... we find that learning experiences which are highly organized and interrelated may produce major changes in behavior related to complex objectives. ... Such new objectives can best be attained where the individual is separated from earlier environmental conditions and when he is in association with a group of peers who are changing in much the same direction and who then tend to reinforce each other.

The three objectives of primary concern in this study are intimately bound up in the construct of Project Prometheus.

As societal complexity and knowledge increase geometrically, the need to process information critically becomes essential to decision making. A perusal of the objectives put forth in the various yearbooks of the National Society for the Study of Education confirms that this is a prime objective of educators. The majority of studies reported involve a particular method or course designed specifically to attain this objective. Evidence of the success of these courses is
contradictory, as indicated in the studies by Sorensen (87) and those reported by Dressel and Mayhew (18). Furthermore, Ennis (25, p. 19) has stated that:

We also need to know the pattern of human development in the various aspects of critical thinking under the various environmental conditions that exist today without any particular concerted effort to teach critical thinking.

The question of concern in this study is to what extent are students who have participated in Project Prometheus proficient in critical thinking as measured by the Watson-Glaser Critical Thinking Appraisal?

The emphasis on creative thinking as a desirable goal of education is relatively new. As late as 1954, Dressel and Mayhew, in the report of the American Council on Education entitled, General Education - Exploration in Evaluation (18, p. 37) stated that:

The issue of creative thinking was regarded as important but outside the province of the committee to resolve. The committee was unwilling to take sides as to any differences which might exist between the creative act and the critical act. Rather the committee was willing to accept, for the purposes of compromise at least, the hunch that creativity and criticalness might be merely differing degrees of the same essential process.

More recent studies by Getzels and Jackson (37), Drevdahl (19), Lowenfeld and Brittain (61), Torrance (92) and Gallagher (36) indicate that creative individuals in diverse fields can be identified as having certain characteristics that contrast them with their less creative peers.
If there are differences, the importance of identifying these differences and providing for the development of the abilities that are necessary for the full expression of creative thinking have obvious applications in the field of education. Torrance (69, p. 33) stated the case succinctly in a paper delivered to the Minneapolis Teachers League on May 20, 1959:

I believe it is tremendously important to society that our creative talent be identified, developed and utilized. The future of our civilization depends upon the quality of the creative imagination of our next generation. Perhaps our need is not so much for more scientists and engineers but for more creative scientists and engineers.

A perusal of the various definitions of creativity yields a common core of characteristics of value in constructing an environment conducive to the development of this ability. Guilford (41), and Torrance (91), in extensive research programs, have found that creative individuals differ in at least three distinct abilities.

1. Fluency of thinking; the facility with which ideas can be generated.
2. Flexibility of thinking; the facility with which they can reject habitual, conventional, or previously successful ways and strike out in a new direction.
3. Originality of thinking; ideas generated are new, to the individual and perhaps to his culture.

Rhodes (72, p. 305), emphasizes that creativity has four aspects: Person, Process, Press, and Product. Definitions revolve around one or more of these aspects in various combinations. Of prime concern to studies involving industry is the Product of creative
thinking, while psychological studies appear more concerned with Process and Person. The environmental pattern of circumstances necessary for releasing creativity is a primary consideration of the present study, for as Flescher (29, p. 266) has stated:

There is inestimable value in an educational climate which permits the expression of idiosyncratic needs, maintains a tolerance for innovation, is receptive to divergent thinking activity, and encourages creative leadership. Such an atmosphere would be psychotherapeutic and growth facilitating, enabling significant development along such behavioral continuums as: rigidity-flexibility; fantasy; generality-originality. This approach is consistent with the ideas of teaching the 'whole' child, of meeting the global needs of the student, and of preserving the identity of the individual.

Suchman (34, p. 20) has further discussed the environmental structure conducive to higher levels of thinking and has concluded that:

Open-mindedness in theory building enhances creative thinking and makes it easier to organize one's conceptual schemes when data so dictates. Fixed ideas and conclusions can stand in the way of fluid accommodations and render inquiry sterile and powerless to produce new constructs and theories.

Description of Project Prometheus

Project Prometheus held a three year contract from the U. S. Office of Education under Title III, P. L. 89-10 (The Elementary and Secondary Education Act of 1965) to create and operate a six week residential summer high school during the project years 1966, 1967, and 1968, for 200 high school students annually. Drawing its student population from ranks of "rising juniors" and "rising seniors" in the
forty-eight cooperating high schools which dot the mountain region of southwestern Oregon, the project embraced seven counties (Coos, Curry, Douglas, Jackson, Josephine, Klamath, and Lake), containing 327,430 persons of whom 24,312 were high school students.

The Project united five intermediate education districts, five private schools, two county units, two city high school districts, forty-three public high schools, two regional chapters of the Oregon Council for Curriculum and Instruction, Southern Oregon College, and the Oregon State Department of Education. Some thirteen regional cultural organizations were involved, as were various public agencies and organizations, not including interested individuals. The total number of organizations who participated number well over one hundred.

Oriented to the social sciences and the humanities, the project employed twenty creative teachers and counselors to operate the residential phase of the program, drawing its staff from elementary schools, high schools, junior colleges, colleges, universities, educational organizations, and private business.

Educationally unique, the school provided a woven matrix of experience and concept for its students, utilizing a six strand construct involving mini-courses, a lecture-demonstration series, conversational dialogues, inter-disciplinary classes, cultural experiences in the various lively arts, and field trips. Generally, the project
introduced its students to concepts and ideas necessary to understand the forces of change wracking the contemporary world.

The 28 major classes and a like number of mini-courses ranged in topics from an examination of "Theories of Human Interaction" to "Animal Communication Patterns" and "Patterns of Change," and emphasized the inter-disciplinary nature of knowledge.

Prominent national figures addressed the Prometheans, including James Farmer, Robert LeTourneau, Adolf Berle, Fulton Lewis III, Senator Mark Hatfield, Congressman Robert Duncan, Congressman Charles Weltner, Congresswoman Edith Green, Senator Wayne Morse, Congressman John Dellenback, and Dr. H. Wentworth Eldredge.

Some seventy-three regional speakers also addressed the Promethean Scholars during the early morning Perspective series on subjects ranging from the "Backgrounds of the Folk Ballad," to the "Origins of Race Myth."

The Conversational dialogues, called Cultural Conflict Seminars, covered six weekly topics: Ethnocentrism, Urbanization and Human Dignity, Technology and Human Values, Emergence and Aspiration of People in Under-developed Countries, the Conflict Between Liberty and Social Cooperation, and Leadership in a Multi-Cultural World.

Some thirty-nine cultural experiences were available annually through the evening Horizon series. These experiences included such programs as Shakespearean plays, restoration drama, art shows,
poetry readings, band concerts, chamber music recitals, and ballet performances of a regional music festival. A foreign film series was shown as were programs dealing with folk music, kilty bands, and other similar items.

Tours were taken to Crater Lake National Park, Fort Vannoy Job Corps Center, Kerbyville Museum, Oregon Technical Institute, Rogue Valley Art Association Gallery, Lava Beds National Monument, Jacksonville Museum, the Oregon Shakespearean Festival, Lithia Park, and Peter Britt Music Festival. Some students learned the rudiments of mountain climbing by actual experience in the Siskiyou and Cascade Mountains. Another group toured the Eastern Oregon desert for five days.

The student selection procedures evidenced the concern of Oregon educators that the future decision-makers of Oregon be given educational experiences commensurate with their responsibilities. Additionally, these bright students were given the opportunity to know what it was like to be "average" as the homogeneous grouping provided a distinct social climate unlike the one these students normally occupy.

The uniqueness of the Promethean concept is at least five-fold, dealing with students, teachers, structure, attitude and cooperation. Specifically, Project Prometheus provided seven counties of a distinct geographic sub-region with an opportunity for regional cooperation,
a cooperation which had not been gained in any other way.

For a more detailed description of the history, objectives, environmental structure, instructional pattern and selection procedures employed in the project, the reader is directed to the Appendix.

Summary

In a world faced with exploding populations and increasingly complex problems there is a critical demand for intelligent action. Endowed individuals have a unique capacity to engage in intellectual activity. Stimulus deprivation resulting from limited experiences incapacitates and deadens intellectuality resulting in a loss of potential contribution to society.

If a six weeks residential program based upon the five strand construct of Project Prometheus can materially affect the attainment of the complex education objectives of critical and creative thinking and significantly increase student involvement in intellectual and cultural activities it will have obvious implications for future design of curricular programs. Furthermore, it will serve as a prototype to rural areas as an example of a cooperative effort to provide educational opportunities otherwise unavailable.
II. REVIEW OF RELATED LITERATURE

Introduction

Project Prometheus was funded under the provisions of Title III of the Elementary and Secondary Education Act of 1965, (Public Law 89-10). To meet the qualifications of Title III, the project had to be both exemplary and innovative in structure and content. A review of the literature dealing with differential education for able and gifted high school students confirmed the innovative nature of the project and revealed that while many former studies had dealt with various aspects under consideration in the present investigation, no single study was similar to the global aspects involved in the evaluation of Project Prometheus.

Literature pertinent to the need for differential education programs and the objectives of Project Prometheus was reviewed in Chapter I, and numerous studies have been reported by Bereday (2), Crow (16), Everett (26), Gallagher (1, 34, 35), Havighurst (42), Henry (44), Hildreth (47), Kough (55), and Witty (97) involving one or more of the following aspects:

Identification of the Gifted
Characteristics of the Gifted
Guidance of the Gifted
Teachers of the Gifted
Motivation of the Gifted
Administering Gifted Programs
Community Agencies and the Gifted
Gifted Children in the Regular Classroom

In this chapter studies which relate to residential summer
schools for able and gifted high school students, to the reduction of
dogmatism and rigidity, and to the teaching of critical and creative
thinking will be reviewed.

Studies Related to Residential Summer Schools for Able
and Gifted High School Students

Morris Meister (97, p. 220), in describing the need for special
provisions in high school for gifted students, stated that:

The human mind develops best when opportunities are given
for creative and meaningful experience. Yet the high school
curriculum, with its many subjects in neat compartments,
provides a mechanistic approach to learning. The curriculum,
for the student, is the sum of a number of constants and
variables. Little attention, if any, is paid to the integration
of subjects (constants and variables) into an organic whole.

To achieve integration effectively for the adolescent, one
must have a central purpose. Such a purpose exists for
students in a specialized high school. The greater interest,
level of ability, and terminal aim opens up opportunities,
not otherwise obtainable, for bringing ideas together that
belong together. Although syllabi may look the same for
both types of schools, the teaching and the learning which
result from them are distinctly different. One needs only
to visit a classroom in English or social studies or physics
in a specialized high school to be impressed by the extent
and the quality of curriculum integration and by the superior
performance of the students.

Examples of special schools devoted exclusively to able and
gifted students are listed in Hildreth (47), Witty (97), Everett (24),
and Bereday (2). These range from schools with a narrow range of purpose such as the Brooklyn Technical High School, the Bronx High School of Science and the High School of Performing Arts in New York City to comprehensive high schools whose purpose is to give a well rounded education to able and gifted children such as the Homewood demonstration school in Baltimore or the Hunter High School for girls and the Stuyvesant High School for gifted boys in New York City. A close perusal of the location of these special schools points up the plight of the rural youth as indicated in Chapter I. All of the special schools are located in metropolitan areas. Rural areas do not have the resources to support a special school for gifted students. Consequently, a study of the literature concerning differential education reveals that special provisions for gifted students in rural areas are either in the form of acceleration within the school system, enrichment within the regular school curriculum, or special summer school programs.

Summer programs for gifted high school children also span a broad range of purposes and of programs. Reichelderfer (71) described a program at Ohio State University in which high school seniors were admitted to regular college classes during the summer. A similar program at Donnelly College, Kansas City, Kansas in which gifted high school students participated in a course in Great Books has been described by Keeler (51). MacLean and Carlson (44)
describe advanced standing and early admissions programs that have been operative for several years at the University of Chicago, Columbia, Wisconsin, Yale, Fisk, Goucher, Lafayette and other colleges who have participated in projects underwritten by the Ford Foundation's Fund for the Advancement of Education. While some of these programs were operative in the summer, all were modifications of regular college programs rather than programs evolving from within high schools.

Hildreth (47, p. 367) reported that since 1956 the National Science Foundation has sponsored summer programs for superior science and mathematics students in over 150 colleges, universities and research organizations. Most programs did not duplicate high school work and allowed participants to apply for early admissions or advanced standing if they chose to do so. Research on achievement supports the contention that the students did as well or better than their college age classmates.

The advanced studies program of St. Paul's School in Concord, New Hampshire, made possible by a grant from the Ford Fund, represents an attempt to concentrate an entire year of work in a subject matter area into an intensive six week period during the summer. Similar programs are reported (47) at Philips Andover, Mount Hermon, St. Mark's and Thayer Academy in Massachusetts. These private preparatory school programs together with similar projects
in operation in other private and public schools from Newton, Massachusetts to Clayton, Missouri again represent programs designed to accelerate the education of gifted high school students by concentrating on a single area of knowledge.

Kerr (53) described a summer program at Mt. Holyoke College designed to prepare high school girls for the rigorous academic life at independent colleges. Sponsored by the A Better Chance Independent School Talent Search (ABC/ISTS) and funded by the Rockefeller Foundation and the Office of Economic Opportunity, the program entailed concentration in English and mathematics. Evening activities such as art, music, creative writing and other seminars added breadth to the program and provided interest areas for the students to pursue. Results from questionnaires sent out to previous participants in the program indicated that a very high percentage of participants subsequently attended independent colleges. A similar program was reported for boys at Dartmouth.

Relatively few summer programs have been reported that attempt to correct the educational deficiencies that plague the gifted high school student from a rural or depressed area where adequate facilities, teachers, and motivation to develop their full potentials are lacking.

One of the first regional attempts to provide differential education for gifted high school students was initiated in 1963 on the campus
of Salem College, Winston-Salem, North Carolina. Called the Governor's School of North Carolina, the residential summer program was funded by the Carnegie Corporation and contributions from local business firms and foundations.

The objectives of the school were four-fold (7, p. 1):

1. to provide for selected highly gifted secondary school students in North Carolina a variety of distinctive educational experiences to supplement the usual provisions of the local school and community.

2. to provide in the character of the special school certain experimental and model practices which may stimulate schools and colleges toward further improvement in their present pattern of provisions for exceptionally able and talented youth.

3. to provide an appropriate setting and functional models for intensive professional training in administrative and curricular modification for talented boys and girls.

4. to make possible, and to conduct, scientific studies of the developmental problems of exceptionally endowed youth, and of related educational provisions, for contributions to behavioral science, and to the conservation and development of human resources in North Carolina, in America and in the world community.

Four hundred rising juniors and seniors from throughout the state were invited each project year to participate in an eight-week residential program on the Salem College campus. The instructional program included 18 classroom hours a week in a major interest class selected from the traditional subject matter areas, three hours a week from one of the performing or fine arts, and four hours a week in a class entitled "Essential Ideas." Special lectures, recitals,
and supervised recreational activities were also available.

Evaluation of the effects of the program involved determining what kind of student was selected and what kind of experience did he have.

Information pertinent to the kind of student selected was gained by administering a series of tests covering major sectors of personality traits including the following (7, p. 110):

- **Terman Concept Mastery Test**
- **Strong Vocational Interest Blank**
- **Allport-Vernon-Lindsey Study of Values**
- **Minnesota Multiphasic Personality Inventory**
- **Gough Adjective Check List**

In addition, teacher ratings were secured with a device comprising five sectors (7, p. 110):

- Knowledge of Areas
- Skills and techniques
- Motivation
- Comprehension
- Articulation

The only results reported in the *Staff Report* (7) are scores on the French and Spanish tests published by the Educational Testing Service. Percentile ranks based on national norms indicated that the students in the foreign language classes ranked considerably higher than the national norms and evidenced a considerable amount of growth as shown by pre and post-test rankings. Similar results are
reported for the three years included in the Staff Report.

Further evaluation into the aspects of the development of Self-Concepts and curriculum research have not been reported at this time.

A program with a slightly different purpose was initiated at Yale University in 1964 with the assistance of the National Science Foundation, the Ford Foundation, and the Hampton Institute. Entitled the Yale Summer High School, the program provided an extensive educational experience for 100 able high school sophomore boys (28, p. i), "... who were being held back by the interwoven burdens of cultural deprivations, educational disadvantage, and economic hardship."

Students were selected from the entire United States in an attempt to get as wide a diversity of backgrounds as possible.

The major purpose was to challenge students to continue their education through college.

The curriculum of the summer school was designed to provide the necessary skills to survive in school as well as to create a desire in the students to pursue a college education. Courses included English Composition and Literature, Science, Speech, Study Skills and Mathematics. In addition, students attended seminars in topics such as: foreign affairs, race and revolution, emerging nations, and moral philosophy.

An extensive battery of measures of intellect, personality and attitude was administered on a pre-test post-test basis with a group
of 18 tenth graders from a New Haven high school serving as a control group for most tests.

The five intellectual scores employed as criteria were derived from the Preliminary Scholastic Aptitude Test of the Educational Testing Service. These criteria were (27, App. II):

Verbal
Mathematical
National Percentile Rank for Verbal
National Percentile Rank for Mathematical
Algebra

The group as a whole improved significantly on each of the five criteria, but as a control group for this test was not available, caution must be practiced in interpreting the results as being due exclusively to the program.

Personality change scores indicated that the Yale Summer High School boys scored significantly lower than the control group on the following measures (27, App. II):

Intolerance of Ambiguity
Authoritarianism
Happiness
Concentration

Higher scores than those for the control group were recorded for the following factors:

Alienated
Machiavellian
Aggressive
Hostility
Deactivated
The research director of the program concluded that (27, App. II):

These results suggest a positive change in intellectual and personality flexibility, more evidenced by increased feelings of apprehension and alienation two days before returning to their home community, after what they felt was a very exciting and stimulating summer experience.

Other interesting conclusions were that the Yale Summer High School appeared to have a fairly uniform effect upon both urban and rural and white and non-white students, and that the various teaching methods included in the design did not seem to be paramount factors in producing the recorded changes in intellectual and personality criteria. This last conclusion has interesting implications in terms of the global concept of Project Prometheus.

The Eighth Congressional District Honors Program described by Solomon (85) represents an attempt to provide differential education for able and gifted high school students from the Eighth Congressional District of Georgia. Operating from the campus of South Georgia College, this residential summer session had the following major objectives (85, p. 2):

1. To stimulate and challenge intellectually gifted and artistically talented high school students.
2. To offer them enriched educational experiences.

The 17 major and minor courses were organized along traditional subject matter lines. Diversity was added to the program by providing small group seminars in basic contemporary issues and
problems, and by semi-weekly cultural events.

Characteristics of the student population were generally similar to the target population for Project Prometheus. At least one student from each county was selected on the basis of the following criteria:

1. nomination by teachers
2. upper 10 percent in class
3. I.Q. - 120 and above
4. two years acceleration in achievement

A total of 149 participants were selected and tested to determine the characteristics of the sample. Scores on the Large-Thorndike Intelligence Test indicated a mean I.Q. of 116.2 for the group.

Results from the administration of the Watson-Glaser Critical Thinking Appraisal on the 22nd day of the program placed the group in the 82nd percentile for 11th graders and the 74th percentile for seniors, based upon national norms.

Evaluation of the effects of the program was on the basis of growth in achievement in traditional subjects as measured by the Stanford Achievement Tests.

The sparseness of research on residential summer programs for able and gifted high school students is indicative of the unique nature of the programs and points up the need for research in this area.
Studies Related to Dogmatism and Behavioral Rigidity

The development of flexible open-minded individuals has often been implicit in the description of desirable behavioral objectives in education, yet few studies have been reported that deal directly with these aspects. Research to date has been concerned primarily with the development of instruments to measure rigidity-flexibility and dogmatism, and with attempts to correlate these factors with measures of various cognitive and non-cognitive aspects of pupil behavior.

Kemp (52) studied the relationships between critical thinking ability and dogmatism by comparing students identified as open-minded with those identified as closed-minded as to their progress in developing critical thinking abilities. Utilizing Rokeach's Dogmatism Scale and the Watson-Glaser Critical Thinking Appraisal as criterion measures, he found that the open-minded students showed greater improvement in critical thinking than those with closed minds. He further concluded that favorable conditions for improvement in critical thinking can be characterized as permissive, where the usual classroom threats are minimized.

In an investigation comparing high school students in a lab-centered and a lecture-demonstration pattern of instruction in biology, Sorensen (87) found that students in the lab-centered biology program evidenced a significant (.05) decrease in dogmatism. No significant
decrease was noted in the lecture-demonstration centered group. Upon stratification of the lab-centered group on the basis of I.Q., he found that the students in the upper range showed no significant decrease. He concluded that a lab-centered program in biology can significantly decrease the dogmatic behavior of high school students. He further concluded that the lack of a significant decrease in dogmatism for the upper I.Q. range was partially due to the fact that on the pre-test those students were already less dogmatic than those in the lower I.Q. ranges.

In an investigation into the relationship of dogmatism to school achievement, Ehrlich (24) found that scores on the Dogmatism Scale were negatively correlated with achievement in an introductory sociology course. Using scores on the School and College Ability Test to hold ability constant he found that the partial relation between dogmatism and achievement (−.43) was significant at the .01 level of confidence. A partial relation between scores on the Dogmatism Scale and the SCAT was also found to be negative (−.28) and significant at the .05 level of confidence. From these results he concluded that achievement in an introductory sociology course was significantly related to dogmatism.

Costin (14) duplicated Ehrlich's study utilizing a group of students in a psychology course and found that the relation of scores on the Dogmatism Scale to achievement in psychology and to scores
on the SCAT were negative but non-significant. He concluded that
general achievement in psychology was not significantly related to
dogmatism and that the discrepancy between his results and those of
Ehrlich may have been due to different kinds of dogmatism.

Zurcher (101) noted that in an investigation involving 517 col-
lege sophomores and freshmen, dogmatism was negatively related to
verbal intelligence at the .001 level of significance. Mouw (67),
using the Dogmatism Scale, found that the more complex the cognitive
behavior, the more the performance is affected negatively by the
degree of dogmatism.

In an analysis of results of research into the relationship of
rigidity and problem solving, Carpenter (6) found that atmospheres
that allowed for more flexibility in problem solving could be
characterized as permissive. He further found that flexibility may be
promoted by exercises in creating novel uses for every day objects
and rewarding unusual but meaningful suggestions. In relation to
critical thinking, Carpenter noted that when students are made overly
anxious about their chances of obtaining a certain level of success in
the course, the probable increase of rigidity in critical thinking is
one of several effects. In summary, Carpenter (6) listed the following
conditions and operations which increase rigidity,

1. personal threat
2. set for speed
3. lack of preparation for real-life situations
4. authoritarian teachers
5. lack of maturation
6. increase of effort
7. partial reinforcement
8. massed practice
9. rate practice
10. docile behavior
11. lack of variation in the stimulus complex
12. action on part of parents and teachers that stifle imagination.

Solomon (86) reports a series of studies in which it was determined that individuals who manifested a rigidity of the thinking process reacted differently to various factors concerned with the scientific method. He concluded the statistical analysis of the data by stating (86, p. 269):

That there is a relationship between non-rigidity and comprehensiveness of cognitive structure and between rigidity and narrowness of cognitive structure has been indicated above. The rigid individuals seem to show an inability to go beyond the mere factual information at hand and react on the basis of each individual fact separately. The rigid group does not indicate the ability to see a relationship of one piece of factual information to others. The individuals of the rigid group may even simply refuse to consider some facts that are at their command.

Gaier, (32) found similar results in a study involving selected personality variables and critical and creative thinking abilities of students in discussion classes. He found that students identified as rigid by administration of the Rorschach Tests tended to be the best in knowledge of specific information ($r = .73$) but were completely unable to apply ideas and principles to new or unique situations or to effect any synthesis or integration of the new ideas. ($r = -.71$).
In an investigation comparing rigid individuals with flexible individuals in their skills in critical thinking, Shockley (84) found that the group identified as flexible on the basis of the Test of Behavioral Rigidity, did significantly better on the thought processes measured by the Watson-Glaser Critical Thinking Appraisal than did the group identified as rigid.

Fleming (28) conducted an investigation into the relationship of attitudinal rigidity to creativity using a series of tests developed by Torrance. He found that there was a significant \( r = -0.41 \) negative correlation between rigidity and verbal creativity. He further noted that it was possible to differentiate between rigid and flexible individuals and non-creative and creative on the basis of certain personality factors. Common to both rigid and non-creative individuals were the factors of inflexibility, lack of self confidence, intolerance of ambiguity, and a compulsive need for discipline and orderliness.

Burton (4, p. 245) summarized a great many theoretical analyses of various aspects of thinking by emphasizing that all research points up the need for flexibility, for fluency of hypotheses, and for diversity and creativity in problem centered programs.

**Studies Related to Critical Thinking**

A majority of studies dealing with critical thinking involve an attempt to determine if the use of a particular teaching method or the
study of particular subject matter is conducive to the development of critical thinking abilities. Dressel and Mayhew (18, p. 36) have emphasized this point by asking the question, "Is critical thinking teachable without reference to any particular body of knowledge?"

In an examination of research on this topic they found that course differences, classroom techniques, background and teaching method do not seem to be particularly effective as determiners of scores on the Test of Critical Thinking in Social Science. Evidence from studies at the college level indicated that the development of critical thinking abilities was not significantly facilitated by an individual course dealing specifically with how to think critically. Differences in gains in critical thinking were found to vary considerably between colleges with quite different programs. Characteristics of colleges showing the greatest gains in critical thinking ability were (18, p. 246):

1. Residential
2. General education oriented
3. General education not confined to courses
4. Strong administrative interest and active coordination of general education as a unit.

On the basis of their findings, Dressel and Mayhew concluded that (18, p. 66), "The process of critical thinking, not the answers to specific questions, should be the goal of instructors." Kastrinos (50), in a study of 50 high school students in Glen Ellyn, Illinois found that there was no significant difference in critical thinking abilities as measured by the Watson-Glaser Critical Thinking Appraisal between
students taught by the textbook-recitation method and a comparable
group taught by a principles-critical thinking-problem method. Dif-
ferences between the two groups as measured by a critical thinking
test constructed by Kastrinos were significant at the .05 level of
confidence. Similar findings were reported by Henderson (43) in a
two year study involving 1500 high school students in Evanston Town-
ship High School. Differences in critical thinking ability as measured
by the **Watson-Glaser Critical Thinking Appraisal** between students
exposed to special instruction in critical thinking and students who
were not exposed to the special program were significant at the .05
level in favor of the experimental group. Differences between the
two groups as measured by the **American Council on Education Test
of Critical Thinking** were not significant. Lyle (62, p. 130) also con-
ducted a study on the teaching of critical thinking involving two classes
taught by special methods. Special instruction designed to emphasize
critical thinking was used in the experimental class and a conventional
teacher-centered method was used in the control. Using the **ACE
Test of Critical Thinking** he found that there was no significant dif-
ference in gains between the experimental and control groups.

In a study previously alluded to under the section dealing with
studies in dogmatism and behavioral rigidity, Sorenson (87) found that
students in the lab-centered program showed significant gains in
critical thinking based on the **Watson-Glaser Critical Thinking**
Appraisal and the Cornell Critical Thinking Test.

Wallen (93) studied gains in critical thinking between students in U. S. History classes who were taught a three week unit on critical thinking followed by application of the principles to the course content. Using the Induction, Deduction, Semantics Critical Thinking Test he found that the experimental group showed significant gains over the scores of a control group from the preceding year. Significant gains in favor of the experimental group were also noted when a control group from the same year was compared. Differences between the experimental and control groups as measured by the Watson-Glaser Test were non-significant.

Yager (98) studied high school biology students using three groups of students studying the Biological Science Curriculum Study blue version. One group utilized the regular text book and a second group utilized the text plus multiple references. The third group utilized multiple references but no text book. He concluded that the use of multi-reference materials caused students to develop more skill in critical thinking than textbooks used alone based on scores on the Watson-Glaser Test.

In a study involving 51 biology classes in Oregon, Howe (49) found positive gains in critical thinking in a majority of classes studied based upon scores on the Watson-Glaser Test.

Brown (3) studied the effect of studying chemistry on the
development of critical thinking abilities of 302 high school students in Tacoma, Washington School District. He found that while the study of chemistry produced gains in critical thinking as measured by the Cornell Critical Thinking Test, mean scores of students who had studied chemistry were not significantly greater than the mean scores of students who had not studied chemistry.

In another study involving the effect of special programs or classes on the development of critical thinking abilities Craven (15) compared a group of 36 science teacher candidates at Oregon State University with several groups who had not had academic preparation in science. Results indicated that critical thinking ability was not a major outcome of the study of college science.

Further conflicting evidence is provided in the studies by Rust (79), Herber (45), Rothstein (76), Richert (74), Fogg (30), Graham (40), Mason (66), Yudin (100), Lee (58), Kopans (54), and Anderson (1) in which it is quite evident that while critical thinking can be taught it is not the exclusive domain of any one teaching method or specific subject matter. Dressel and Mayhew emphasized this point when they stated (18, p. 181):

Still one further weakness in critical thinking research lies in the fact that the way it is presented too often suggests that emphasizing critical thinking can be a mechanical sort of operation tacked onto some particular . . . course.

In light of this conflicting evidence it is important that research be designed to determine what administrative and curricular
innovations are necessary to provide a pervasive atmosphere in the entire school program that is conducive to the development of critical thinking abilities.

Studies Related to Creative Thinking

Prior to the pioneering work of Guilford (41), Torrance (91), Lowenfeld (60), Gallagher (35), Drevdahl (19), Taylor and Barron (89) and others, very little critical analysis was undertaken on factors dealing with creative thinking. With the publication of Guilford's (41) factor analytical studies on the structure of the human intellect, however, interest in this area has increased tremendously.

Investigations generally focus around three basic categories:

1. Characteristics that differentiate creative individuals from non-creative individuals.

2. The relationship of creative thinking to other measurable factors such as intelligence and achievement.

3. The effects of different methods of instruction on the development of creative thinking.

Most investigations center around one of the first two categories due to the relative newness of the concept and the need for a clear definition of what creative thinking involves. Of paramount concern in the present investigation is category number three dealing with actual practices designed to implement creative thinking. Few investigations concerning this aspect have been reported.
Studies by Drevdahl (19), MacKinnon (64), Drevdahl and Cattell (20), Cattell and Drevdahl (10) and Lowenfeld (60) have attempted to identify personality factors that discriminate between creative and non-creative individuals.

In three different investigations Drevdahl (10, 19, 20) in collaboration with Cattell determined, with the use of the 16 Personality Factor Test, the personality profiles of various groups of individuals identified as creative.

In a study involving eminent researchers, teachers and administrators, Cattell and Drevdahl (20, p. 251) found that the creative individuals differed from non-creative individuals in that they were:

1. more intelligent
2. more dominant
3. more adventurous
4. more sensitive
5. less anxious
6. more radical
7. more self sufficient

Of special significance was the fact that the individuals in the creative group exhibited much the same profile regardless of whether they were researchers, teachers or administrators.

In a second investigation Drevdahl (19) selected a group of 90 scientists and artists from the University of Nebraska and administered the 16PF and a series of tests derived from Guilford's factor analytic studies of creative thinking. After dividing the groups into creatives and non-creatives he found that creative artists possessed the same
intellectual characteristics as creative scientists. Both groups were characterized as:

1. more radical
2. more self sufficient
3. more withdrawn
4. more concerned with ideas
5. possessing greater verbal facility
6. possessing greater fluency
7. possessing greater flexibility
8. possessing greater originality

These results coincide with the findings of an independent study conducted by Lowenfeld (60) using a different battery of tests to determine the intellectual characteristics of creative artists.

Further evidence to support Drevdahl's contention that creative individuals differ from non-creatives on the basis of personality factors is evidenced in a study by Drevdahl and Cattell (20) in which a group of artists selected on the basis of having appeared in Whos Who in American Art and a group of writers selected on the basis of having published extensively were compared to a normal population. Results indicated that both groups differed in personality profiles from the normal population in the same manner as did the population of eminent researchers, teachers, scientists and administrators previously alluded to.

MacKinnon (64) studied creative architects at the Institute of Personality Assessment and Research in Berkley, California and found that they could be characterized as being:
1. more inclined to have a good opinion of themselves
2. open to feelings
3. high in self awareness
4. wide in range of interests
5. tolerant of disorder
6. flexible and spontaneous
7. intuitive
8. dominant
9. self-confident
10. intelligent
11. aggressive and self assured
12. free from conventional restraints
13. less motivated in situations requiring conformity
14. more autonomous

The general agreement evidenced by these studies tends to support the contention that creative thinking ability is a complex of many personality as well as intellectual factors.

Studies attempting to establish the relationship of creative thinking ability to intelligence and achievement were given impetus by the studies of Getzels and Jackson (38) in the middle 1950's. Getzel and Jackson found that traditional use of intelligence as a measure of giftedness tended to neglect many high achievers. They postulated that (38, p. 75):

... if we recognize that learning involves the production of novelty as well as remembrance of course content, then measures of creativity as well as I. Q. might become appropriate in defining characteristics of giftedness.

To study the relationship of creativity to achievement, Getzels and Jackson divided high school students from a midwestern school into two groups, one that scored in the top 20 percent on the basis of an I. Q. test but not in terms of creativity, and another that scored
in the top 20 percent on the battery of creativity tests but not on the I.Q. test. They found that despite a 23 point difference in I.Q. both groups were equally superior in achievement over the population as a whole. A further finding of interest was that teachers preferred high I.Q. students in class while they ranked highly creative individuals equal to the general population of the school.

Studies by Cline, Richards and Needham (12), and Torrance (92) indicate similar results in partial replications of Getzels and Jackson's study. However, several investigations by Fugie (9), Yamamoto (99), Edwards and Tyler (23), and Flescher (29) found that while intelligence is a powerful determinant of academic achievement, the data did not allow the inference to be drawn that creativity is significantly related to achievement. The Getzels-Jackson phenomenon was not evidenced.

Yamamoto (99, p. 324) reported the following correlations as evidence for this conclusion:

<table>
<thead>
<tr>
<th></th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.Q. vs. Creativity</td>
<td>.12 , .01</td>
</tr>
<tr>
<td>Achievement vs. Creativity</td>
<td>-.16 , 21</td>
</tr>
<tr>
<td>I.Q. vs. Achievement</td>
<td>.63 , .86</td>
</tr>
</tbody>
</table>

Cicirelli (11), working with 6th graders in Detroit found that while his results agreed with those of Getzels and Jackson, the relationship between creativity and achievement was weaker and decreased as I.Q. increased.

Bish (92) in a study involving the use of the Torrance Tests of
Creative Thinking and the California Achievement Test reported correlations that ranged between .36 and .42. These correlations increased when intelligence was partialled out.

In an analysis of a large number of studies, Torrance (92, p. 95) concluded that in identifying gifted students on the basis of traditional I. Q. tests approximately 70 percent of the most creative individuals would be eliminated from consideration.

In Creativity: Progress and Potential, Taylor (88) reports an almost total lack of field or laboratory experiments at the high school level designed to nurture creativity. This expression is fortified by Getzels and Jackson's (89) statement that, "We are perhaps more in the dark about the environmental conditions which facilitate creativity than we are about any other aspect of the problem."

Torrance (92) has reported a number of studies that have dealt with preferred ways of learning, methods of teaching and special materials. In a pair of studies of the relationship of creative thinking ability and preference for open-structure learning experiences, Clark and Hamburg (92, p. 41) at Cornell University found that there was a significant positive relationship between creativity and preference for open-structure. Rath and MacDonald (92, p. 42), using elementary students placed children in curricular tasks varying in openness of structure, frustration and passivity, and found that highly creative children, as measured by the Torrance Tests of Creative Thinking
were more productive on frustrating tasks than their less creative peers. Torrance (91) found in two separate studies that students who assumed a constructive rather than a critical attitude towards available information were able to produce a larger number of creative solutions and more original ones.

Enochs (92) found that by changing teachers' behavior and attitudes towards the acceptance of a greater number of pupils' ideas, pupils of the experimental teachers showed greater gains than those of control teachers.

In a study involving learning in a social studies class in junior high school, Hutchinson (92, p. 52) found a statistically significant positive correlation between mental age and achievement but not between measures of creative thinking and achievement in classes taught under traditional authoritarian methods. In the classes characterized by opportunities to learn in creative ways the reverse was true. Gotkin and Massa (92, p. 52) found significant negative correlations between the Torrance measure of creativity and achievement in a 5th grade language arts class using programmed instruction.

In a study involving sixth-grade students who were taught reading according to two different approaches, Thatcher (92) found that the individualized reading approach seemed to have produced greater gains in creative thinking abilities as measured by Torrance's tests than the method utilizing ability group reading.
In a rather extensive study conducted by Torrance (92, p. 39) in which teachers used a set of materials specifically designed to provide kinds of practice that would bring into play creative thinking abilities, results indicate that those classes using the special units showed more growth as measured by the Torrance Tests of Creative Thinking than did their control groups. Statistical analysis of the data showed that in almost all cases, growth was statistically significant for experimental groups. In many instances the control groups showed losses rather than gains.

Similar results have been reported by Torrance (92) for studies involving a variety of grade levels and courses. Sommers (92, p. 39) reported on a study of college-level subjects in a course in Industrial Art. He found when course content was carefully controlled and only the instructional procedures varied, that experimental subjects showed greater gains in creative thinking ability than the controls. Three replications of the study yielded the same results. Similar results were obtained in studies by Anderson (92) in Industrial Arts, Ragouzis (92) in Art Education, Evan (92) in high school art classes, and De Roche (92) in an elementary school science course.

Studies in which creative thinking activities are presented separate from traditional courses or subject matter content yield essentially the same results. Crutchfield and Covington (92, p. 40) constructed a series of problems in booklet form that utilized creative
approaches to problem solving. Experimental groups using their materials consistently showed greater gains on the Torrance Tests of Creative Thinking than did their control groups.

Cartledge and Krauser (8) with first-grade students, Rouse (77) with retarded children, and Yee (92) with twelfth-grade students have reported results that agree with those reported by Crutchfield and Covington.

The results of these studies seem to indicate that creative thinking abilities are susceptible to development through learning experiences, function differently in different learning tasks and in different ways of learning the same task, and may develop at different rates and to different levels.

Research directed towards an alternate approach to teaching separate component skills, one that creates conditions that stimulate and sustain the inquiry process as a whole, giving the student ample opportunity to experiment with various strategies of attack in all areas of knowledge, could add immeasurably to the growing knowledge about the development of creative thinking abilities.
III. DESIGN OF THE STUDY

The purpose of this study was to evaluate the effects of a six week residential program of differential education for gifted high school juniors and seniors from the seven southwestern Oregon counties. The first major hypothesis of the investigator was that complex educational objectives are best achieved when the entire educational program is geared to providing experiences for students that create an atmosphere conducive to the development of those objectives in all areas of knowledge. The second major hypothesis of the investigator was that the unique matrix of intensive, interrelated experiences, each dependent upon the other and each an integral part of the entire global experience of Project Prometheus could provide the necessary atmosphere to facilitate the accomplishment of these educational objectives. These two hypotheses were investigated by a series of analyses of data collected on tests and evaluation forms.

The purpose of the analysis was to test the null hypotheses indicated in Chapter I. The investigator hypothesized that there might be differences in mean scores on criterion instruments depending upon whether or not students participated in Project Prometheus. Furthermore, the performance of a student on criterion instruments was hypothesized to be, in part, a function of his intelligence and of his
academic ability. Thus the design used to test the null hypotheses concerned with criterion tests was an analysis of covariance utilizing scholastic ability and intelligence as covariance controls.

**The Experimental Design**

The research design was patterned after one suggested by Campbell and Stanley (31, p. 195), referred to as a post-test only control group design, and can be designated as:

\[
\begin{align*}
R_1 & \quad X \quad O_1 \ldots O_{13} \\
R_2 & \quad O_1 \ldots O_{13}
\end{align*}
\]

Where:

- \( R_1 \) represents the Promethean Scholars
- \( R_2 \) represents the Promethean Alternates
- \( O_1 \) represents the *Watson-Glaser Critical Thinking Appraisal*
- \( O_2 \) represents the *Torrance Tests of Creative Thinking*
- \( O_3 \) represents the *Dogmatism Scale*
- \( O_4 \) represents the *Test of Behavioral Rigidity*
- \( O_5 \ldots O_{13} \) represent the nine areas of concern on the long-range evaluation form
- \( X \) represents the variable. In this investigation, the residential summer school program entitled, Project Prometheus.

The sources of internal validity listed by Stanley and Campbell (31, p. 187) are controlled by this design. The rival hypothesis that differences between groups may be the result of selection biases was
controlled by the partial randomization brought about by the
demographic aspects of the selection procedure and by statistically
controlling the selection variables of intelligence and scholastic ability
by using them as covariance controls.

The basic reasons for the selection of a post-test only design
involve the fact that the parent population for the control and experi-
mental groups came from the upper 10 percent of the high school
population based on intelligence tests and academic ability. The
investigator believed that the high scholastic level of the groups, the
relatively short period between selection and final testing, and the
highly unusual nature of the criterion measures would have produced
an interaction effect between testing and the experimental variable,
and would have sensitized the individuals to the tests themselves.

In discussing problems of this nature, Campbell and Stanley
(31, p. 188) state:

Where highly unusual testing procedures are used, or where
the testing procedure involves deception, perceptual or
cognitive restructuring, surprise, stress, etc. designs
having unpretested groups remain highly desirable if not
essential.

The selection of analysis of covariance as the design used to
test the null hypotheses was necessitated by the partial stratification
of the experimental group brought about by the procedures for selec-
tion to participate in Project Prometheus.

Lindquist (59, p. 317) had the following to say about situations
in which control of concomitant variable by randomization is impossible:

In situations in which experimental control of a concomitant variable may be either impossible or unpracticable, it is sometimes possible to resort to statistical control of that variable. ... This method of statistical control is that known as the method of analysis of covariance.

In reference to the same problem, Wert (95, p. 343) had this to say about the use of analysis of covariance.

In general it will provide tests of significance for the comparison groups whose members may have been stratified and whose members have been measured with regards to one or more variable characteristics other than the criterion. ... By using these scores as control variables in the analysis of covariance, the possible bias introduced by individual differences will be removed in so far as these factors adequately represent the differences in general.

In as much as intelligence scores and measures of scholastic ability were used as the selection measures for Project Prometheus, and these variables were used as covariance adjustments in the statistical design for this study, this satisfies the post-test only control group design as described by Campbell and Stanley (31, p. 178).

The Population

The purpose of this research design was to investigate the ability of Promethean Scholars to think critically and creatively and to determine their relative open-mindedness and behavioral rigidity. These characteristics were compared to those of a control group of
Promethean Alternates who met selection requirements for the program but did not attend the summer session due to prior commitments or who were not selected for attendance by the selection board.

The selection of samples for this investigation was dependent on the procedures outlined for application and selection to participate in Project Prometheus, as indicated in the appendix. Initially, all individuals included in the study had to meet these requirements and actively apply. A total of 547 students completed this portion of the procedure. Two hundred students from this group were selected to participate in the project and have been referred to as Promethean Scholars.

Promethean Scholars

Two hundred students participated in Project Prometheus during the 1967 summer session. One hundred and eighty five of these participated in all testing sessions and were included in the experimental group. Of the 185 who participated, 88 were males and 97 were females. The mean age of the Promethean Scholars was 16 years, 6 months.

Promethean Alternates

Of the 347 students who were not selected to attend the program, 250 took part in all testing sessions and were included in the control
group. One hundred of the control group were males and 150 were females. The mean age for this group was 16 years, 5 months.

Data relative to the number, sex, and age of the students in each group are summarized in Table 1.

Table 1. Mean age, number and percent of male and female participants for Promethean Scholars and Promethean Alternates.

<table>
<thead>
<tr>
<th>Group</th>
<th>Age</th>
<th>n</th>
<th>Male</th>
<th>n</th>
<th>%</th>
<th>Female</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>198.4 mo</td>
<td>185</td>
<td></td>
<td>88</td>
<td>47.6</td>
<td></td>
<td>97</td>
<td>52.4</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>197.4 mo</td>
<td>250</td>
<td></td>
<td>100</td>
<td>40.0</td>
<td></td>
<td>150</td>
<td>60.0</td>
</tr>
</tbody>
</table>

The Evaluation Instruments

Watson-Glaser Critical Thinking Appraisal

To evaluate the students' critical thinking abilities, the Watson-Glaser Critical Thinking Appraisal, Form YM was employed. Form YM contains 100 items divided into five subtests, and requires approximately 55 minutes for administration.

The subtests measure the following five aspects of critical thinking (94, p. 2):

Test 1. Inference. (Twenty items.) Samples ability to discriminate among degrees of truth or falsity of inferences drawn from given data.

Test 2. Recognition of Assumptions. (Sixteen items.) Samples ability to recognize unstated assumptions
or presuppositions which are taken for granted in given statements or assertions.

Test 3. Deduction. (Twenty-five items.) Samples ability to reason deductively from given statements or premises; to recognize the relation of implication between propositions; to determine whether what may seem to be an implication or a necessary inference from given premises is indeed such.

Test 4. Interpretation. (Twenty-four items.) Samples ability to weigh evidence and to distinguish between (a) generalizations from given data that are not warranted beyond a reasonable doubt, and (b) generalizations which, although absolutely certain or necessary, do seem to be warranted beyond a reasonable doubt.

Test 5. Evaluation of Arguments. (Fifteen items.) Samples ability to distinguish between arguments which are strong and relevant and those which are weak or irrelevant to a particular question at issue.

Separate answer sheets were provided with reusable test booklets. The test was scored by adding the number of correct responses in each subtest to determine a total number correct for the entire test. This total raw score was used in the statistical analysis as the authors of the test do not encourage the use of subtest scores due to the relatively small number of items represented and their consequent lack of reliability for that purpose (94, p. 9).

In developing the Watson-Glaser Critical Thinking Appraisal, the authors defined critical thinking as a composite of the following knowledge, attitudes, and skills (94, p. 10):
1. Attitudes of inquiry that involve an ability to recognize the existence of problems or an acceptance of the general need for evidence in support of what is asserted to be true.

2. Knowledge of the nature of valid inference, distractions, and generalizations in which the weight of accuracy of different levels of evidence are logically determined.

3. Skills in employing and applying the above attitudes and knowledge.

This definition of critical thinking is in general agreement with the definitions of such authors as Guilford (41), Rust (79), Dressel and Mayhew (18), the Committee of College and University Examiners (13), and the Educational Policies Commission (21). Further evidence in support of this definition is evidenced in the research studies of Rust (78) and Houle (48). These factors and the broad previous use of the instrument were influential in the selection of the Watson-Glaser Critical Thinking Appraisal to measure the critical thinking abilities of the participants in this investigation.

The standardization program for the Watson-Glaser Critical Thinking Appraisal, Form YM involved fourteen school systems in thirteen states. A total of 20,312 students were tested to provide normative information and statistical data. The split half reliability coefficients for the entire instrument ranged from .85 to .87 and represent an acceptable reliability level.

Factor-analytical studies by Rust (78, 79) have yielded three factors of sufficient strength to warrant the conclusion that the
authors' definition of critical thinking as measured by the appraisal is valid. The three factors were: general reasoning, application of logical principles, and verbal understanding. Further evidence of construct validity is apparent from the subtest intercorrelation coefficients ranging from .21 to .50 (94, p. 14). These moderately low values support the contention that distinctive abilities are being measured.

Correlations between this test and tests of intelligence, and scholastic ability are as listed (94, p. 11):

<table>
<thead>
<tr>
<th>Test</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wechsler Adult Intelligence Scale</td>
<td>.41</td>
</tr>
<tr>
<td>Otis Mental Ability Tests: Gamma</td>
<td>.60, .66</td>
</tr>
<tr>
<td>California Test of Mental Maturity</td>
<td>.68</td>
</tr>
<tr>
<td>Miller Analogies, Form H</td>
<td>.55</td>
</tr>
<tr>
<td>College Entrance Exam Board</td>
<td></td>
</tr>
<tr>
<td>Verbal</td>
<td>.54</td>
</tr>
<tr>
<td>Mathematics</td>
<td>.43</td>
</tr>
</tbody>
</table>

The moderately positive correlations suggest that, while a relationship exists between this test and various other intelligence and scholastic ability tests, the Watson-Glaser Critical Thinking Appraisal measures substantially different thinking abilities than the others listed.
Torrance Tests of Creative Thinking

Creative thinking abilities of the students in this study were measured by the administration of the Torrance Tests of Creative Thinking, Form A. Form A, a research edition copyrighted in 1966, consists of a battery of seven verbal tests and a smaller battery of three figural tests. The author selected from a large group of tasks, those that could be administered and scored accurately, and economically, and those that stood best the test of reliability and validity. A further consideration was the need to sample as many different aspects of creative thinking as possible in a relatively short period of time. Time for administration of the entire battery was 75 minutes.

Tasks included in the verbal activities include (92, p. 10):

Ask and Guess Activities:
Activities involve looking at a picture and asking as many questions about the picture as one can without asking questions that can be answered in the picture; guessing possible causes of the action shown; and listing as many possible consequences of the action in the picture as one can. The activities give a picture of the student's ability to develop hypothesis and think in terms of possibles.

Product Improvement Activity:
Students are asked to look at a toy elephant and list the cleverest, most interesting and unusual ways to change it to make it more fun to play with. This activity enables the students to play with ideas they do not normally express in more serious tasks.
Unusual Uses Activity:
The students are asked to list as many new and unusual uses as they can of common cardboard boxes. The task tests the ability of the students to free their minds of a well-established set.

Unusual Questions Activity:
This activity requires that the students think of as many questions as they can about cardboard boxes, questions that people do not usually think about.

Just Suppose Activity:
Students are given an improbable situation such as; suppose clouds had strings attached to them which hung down to earth. Then they are asked to imagine and list which would be the consequences. This task allows the student to "play with" the possibility and imagine all of the things that would happen as a consequence.

Tasks included in the figural activities include (92, p. 14):

Picture Construction:
Students are asked to take an egg shaped piece of paper and place it on a page and make a picture using the small piece of paper as a part of the overall design. The students are directed to make the picture tell as unusual and exciting a story as possible. They are then instructed to give the picture an unusual and clever title. This activity calls into play the tendency towards structuring and integrating.

Incomplete Figures Activity:
This activity involves sketching interesting objects or pictures using ten different incomplete designs. The incomplete figures create tension in the beholder who must control his tension long enough to make the mental leap necessary to get away from obvious and commonplace pictures.

Repeated Figures Activity:
Students are given ten minutes to see how many different and unusual pictures they can make from a pair of parallel lines. This activity requires an
ability to return to the same stimulus again and again and perceive it in a different way.

A survey of the literature on creativity yields a plethora of definitions for creative thinking. Rhodes (72) found 56 overlapping and intertwined definitions, none of which are mutually exclusive. Drevdahl (19), Guilford (41), Taylor and Barron (89), Getzels and Jackson (48), Flescher (29), and Lowenfeld (60) each offer definitions that have certain threads in common. This basic commonality has its roots in the factor-analytical studies of J. P. Guilford (41) on the structure of the human intellect, and involves what Guilford classifies as divergent thinking ability. These abilities are usually condensed into the four factors listed in Chapter I; fluency, flexibility, originality, and elaboration. While the author of the tests used in this study defines creative thinking as (92, p. 6):

... a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypothesis and possibly modifying and retesting them; and finally communicating the results. ...

he has assessed the products that result from the administration of these test activities in terms of Guilford's divergent thinking factors.

In discussing the reasons why he favors this definition of creative thinking, Torrance states that (92, p. 7):

It enables one to begin defining operationally the kinds of abilities, mental functioning, and personality characteristics that facilitate or inhibit the process. It provides
an approach for specifying the kinds of products that result from the process, the kinds of persons who can engage most successfully in the process, and the conditions that facilitate the process. The definition also seems to be in harmony with historical usage and equally applicable in scientific, artistic, literary, dramatic, and interpersonal creativity.

The Torrance Tests of Creative Thinking have been subjected to a number of test-retest reliability studies. Torrance (92, p. 21) reports that Goralski, using Form A for initial testing and Form B, an alternate form, for the retest ten weeks later, obtained reliability coefficients of .82 for fluency, .78 for flexibility, .59 for originality and .83 for the battery total using student teachers as subjects. These values are of about the same magnitude as those reported from a study involving 118 fourth, fifth, and sixth graders in St. Croix, Wisconsin. A listing of the product-moment coefficients of correlation for this study is as follows (92, p. 21):

<table>
<thead>
<tr>
<th>Trait</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Fluency</td>
<td>.93</td>
</tr>
<tr>
<td>Verbal Flexibility</td>
<td>.84</td>
</tr>
<tr>
<td>Verbal Originality</td>
<td>.88</td>
</tr>
<tr>
<td>Figural Fluency</td>
<td>.71</td>
</tr>
<tr>
<td>Figural Flexibility</td>
<td>.73</td>
</tr>
<tr>
<td>Figural Originality</td>
<td>.85</td>
</tr>
<tr>
<td>Figural Elaboration</td>
<td>.83</td>
</tr>
</tbody>
</table>

The above information and the many studies reported by Torrance (92) indicate that there is a generally acceptable level of reliability for the instrument.

The author of the test prefaces his discussion of the validity of the Torrance Tests of Creative Thinking by stating that (92, p. 23):
Since a person can behave creatively in an almost infinite number of ways and since there is a diversity of definitions of creativity, it would be impossible to provide all research workers and potential users of tests of creative thinking satisfactory evidences of validity. The concept of an overall validity coefficient for tests of creative thinking ability is grossly inappropriate.

There have been, however, a number of studies that lend evidence for the validity of these measures. Drevdahl (19, p. 22; 20, p. 109) reports a series of studies in which he measured the personality characteristics of artists, scientists and other individuals that ranked high on a group of tests similar to the Torrance Tests of Creative Thinking. He found that those individuals ranked high on measures of creative thinking differ from non-creative persons in regards to a great number of personality characteristics. When these personality characteristics were compared to the characteristics of individuals rated as creative on bases other than creativity scores, it was found that they shared most of the characteristics.

Torrance (92, p. 25) reports a great number of similar studies in which the Torrance Tests of Creative Thinking were correlated with various other measures. The weight of the evidence reported is in agreement with the findings of Drevdahl (19, 20). This indicates that creative thinking measures such as the Torrance Test of Critical Thinking measure a constellation of factors from the universe of creative abilities.

The moderate to low level positive correlations listed below
strongly suggest that this test measures thinking abilities quite different from those measured by tests of scholastic ability and intelligence.

<table>
<thead>
<tr>
<th>Test</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa Test of Educational Development</td>
<td>.21</td>
</tr>
<tr>
<td>Yamamoto (99, p. 324)</td>
<td></td>
</tr>
<tr>
<td>California Achievement Test</td>
<td>.42</td>
</tr>
<tr>
<td>Bish (92, p. 47)</td>
<td></td>
</tr>
<tr>
<td>Stanford-Binet</td>
<td>.16</td>
</tr>
<tr>
<td>Torrance (37, p. 25)</td>
<td></td>
</tr>
<tr>
<td>Otis Quick Scoring</td>
<td>.32</td>
</tr>
<tr>
<td>Torrance (37, p. 25)</td>
<td></td>
</tr>
<tr>
<td>Kuhlman-Anderson</td>
<td>.26</td>
</tr>
<tr>
<td>Torrance (37, p. 25)</td>
<td></td>
</tr>
<tr>
<td>California Test of Mental Maturity</td>
<td>.24</td>
</tr>
<tr>
<td>Torrance (37, p. 25)</td>
<td></td>
</tr>
</tbody>
</table>

While the test is a research edition, comparison group norms have been established for all forms for grades one through twelve and for several adult and college groups. Tables for converting raw scores to standard or T-scores are based on the test performance of 118 fifth grade pupils in St. Croix, Wisconsin. In regards to the use of this group of pupils for comparison, Torrance states that (92, p. 57):

The author and his associates have found this set of T-scores most useful in comparing relative levels of development or performance on verbal as opposed to figural; on fluency compared with flexibility, elaboration, and originality; from one group to another; and the like. The use of T-scores for all four tests of the same subjects also have the advantage of approximating equivalency. . . . The author has found that the ones based on fifth grade data lend themselves satisfactorily to conversions at both the lower and upper levels educationally.

Scores on the various tasks in the **Torrance Tests of Creative**
Thinking yield the following factors (92, p. 72):

Verbal Fluency: the test taker's ability to produce a large number of ideas with words.

Verbal Flexibility: the test taker's ability to produce a variety of kinds of ideas, to shift from one approach to another, or to use a variety of strategies.

Verbal Originality: the subject's ability to produce ideas that are away from the obvious, common place, banal, or established.

Verbal Elaboration: the subject's ability to develop, embroider, embellish, carry out, or otherwise elaborate verbal ideas.

Figural Fluency, Flexibility and Elaboration: the same as for verbal aspects, except that they are concerned with figural rather than verbal modes of thinking.

In addition to these scores, composite scores for verbal aspects and figured aspects were computed. These two composite scores were then added to arrive at a composite total creative thinking score. While this practice is not recommended when using the tests for clinical purposes, Torrance states that (92, p. 72):

... such a score does seem to give a rather stable index of the total amount of creative energy a person has available or is willing to use. Reliabilities are generally higher for such total scores than for the separate composite scores because a person may spend his energies on one occasion in producing as large a number of responses as possible, giving little attention to elaborating his responses. On a second occasion, he may use his energies in elaborating a few responses or in thinking of unusual or original ones.
Test of Behavioral Rigidity

To assess the position of the students along the rigidity-flexibility continuum, the Test of Behavioral Rigidity was employed. The test consists of three sub tests, each of which yields two or more scores and which combine to give three factor scores (82, p. 608):

1. Motor-cognitive rigidity: a measure of effective adjustment to shifts in familiar patterns and to continuously changing situational demands.

2. Personality-perceptual rigidity: a measure to indicate the individual's ability to adjust readily to new surroundings and change in cognitive and environmental patterns.

3. Psychomotor speed: an indication of the individual's rate of emission of familiar cognitive responses.

The tasks included in the test were selected as a result of a factor analysis of tests reported in the literature and tasks newly constructed by the author of the test. The factor analysis, using a modified version of the multiple-group method resulted in the isolation of the above mentioned factors. Cross-validation was achieved by drawing a new sample and factoring the correlation matrix for this sample. According to Schaie (81, p. 6), "The oblique factor loadings for both analyses were very similar and indicate rather stable structure for the hypothesized dimensions." Langer and McKain (57) also report that the Test of Behavioral Rigidity measures a fairly well defined rigidity factor, a general flexibility factor and a bipolar
rigidity-flexibility factor. These studies indicate the internal consistency of the test. Studies by Schaie (82), Konietzko (83), White (96), and Shockley (84) have established that the Test of Behavioral Rigidity differentiates flexible individuals from rigid individuals on the basis of such diverse factors as intelligence, critical thinking ability, personality factors, educational and income level, occupational level and race. These factors were influential in the selection of the Test of Behavioral Rigidity to measure the criterion of rigidity-flexibility in this investigation.

All material required by the testees was provided in the test booklet. Total time for administration was approximately 30 minutes. Actual testing time consumed was 11 minutes plus the untimed questionnaire material. Standard scores were determined as indicated in the manual (83, p. 9) and a composite factor score was derived by adding the three individual scores.

The use of this composite score was justified on the basis of a large cross sectional study performed by Schaie (83). In this study Schaie found that (83, p. 23):

Although measures of three distinct dimensions were used, it appears that a linear combination of these factors had the best predictive power and that such a composite score discriminated best on other variables. This finding seems to imply that a composite rigidity measure, combining estimates of the several dimensions used to define rigidity, is a useful and discriminating tool.

For the purposes of comparing the results to the norm group,
the composite factor score was divided by three and entered into a conversion table (83, p. 20). This provided a Rigidity Quotient that could be compared to the following classification (83, p. 10):

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Rigidity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>69 or below</td>
<td>very rigid</td>
</tr>
<tr>
<td>70 - 79</td>
<td>rigid</td>
</tr>
<tr>
<td>80 - 89</td>
<td>moderately rigid</td>
</tr>
<tr>
<td>90 - 109</td>
<td>average</td>
</tr>
<tr>
<td>110 - 119</td>
<td>moderately flexible</td>
</tr>
<tr>
<td>120 - 129</td>
<td>flexible</td>
</tr>
<tr>
<td>130 or above</td>
<td>very flexible</td>
</tr>
</tbody>
</table>

**Dogmatism Scale**

The **Dogmatism Scale, Form E**, was developed by Rokeach (75) at Michigan State University and was selected to measure differences in open and closed-mindedness of students who participated in this study. **Form E** consists of 40 items selected from an earlier 66 item scale on the basis of reliability studies.

Individual test booklets with space for answers to each item were provided. The instrument is an untimed scale that took approximately 40 minutes to administer.

The definition of dogmatic thinking that resulted in the construction of the **Dogmatism Scale** emphasized that dogmatism, or closed-mindedness, is expressed as (75, p. 183), "... a total cognitive configuration of ideas and beliefs organized into a relatively closed system." The distinction is between rigid thinking: which refers to resistance to change in single beliefs, sets or habits, and
dogmatic thinking; which refers to the resistance to change of systems of belief.

Rokeach elaborated on his definition by stating that (75, p. 57):

Every person, then, must be able to evaluate adequately both the relevant and irrelevant information he receives from every situation. This leads us to suggest a basic characteristic that defines the extent to which the person's system is open or closed; namely, the extent to which the person can receive, evaluate, and act on relevant information received from the outside on its own intrinsic merits, unencumbered by irrelevant factors in the situation arising from within the person or from the outside.

Following is a summary of the areas for which items were developed (75, p. 73):

1. Accentuation of differences between the belief and the disbelief systems; 1 item.
2. The coexistence of contradictions within the belief system; 2 items.
3. Relative amount of knowledge possessed; 1 item.
4. Beliefs regarding the aloneness, isolation, and helplessness of man; 4 items.
5. Beliefs regarding the uncertainty of the future; 5 items.
6. Beliefs about self-adequacy and inadequacy; 1 item.
7. Self-aggrandizement as a defense against self-inadequacy; 3 items.
8. Authoritarianism; 9 items.
9. Intolerance; 7 items.
10. Tendency to make a party-line change; 2 items.
11. Narrowing; 1 item.
12. Attitudes toward the past, present, and future; 1 item.

13. Knowing the future; 3 items.

Responses to the items were along an agree-disagree continuum in which participants were asked to indicate whether they (75, p. 73):

+1: Agree A Little  -1: Disagree A Little
+2: Agree On The Whole  -2: Disagree On The Whole
+3: Agree Very Much  -3: Disagree Very Much

Negative weights were thus assigned to disagree responses as indicated, and plus weights to the agree responses. The responses were then added, algebraically, with the sum added to a constant of 160. Total scores above 160 indicate relative closed-mindedness, and those below 160 indicate relative open-mindedness.

Odd-even reliabilities, corrected by the Spearman-Brown formula for Form E range from .68 to .93 (75, p. 90), and are considered to be quite satisfactory, especially considering the diversity of apparently unrelated items on the scale. In a study involving high school students, Kemp (52) found that Form E had a test-retest reliability coefficient of .82. Of further significance in Kemp's study is the fact that the scores on Form E had a correlation coefficient of .74 with teacher judgements.

Rokeach used the method of Known Groups to establish the validity of the Dogmatism Scale and found that subjects judged by students in psychology to be highly dogmatic scored considerably and significantly higher on the Dogmatism Scale than those judged to
be low in dogmatism (75, p. 103).

The relation of the Dogmatism Scale to scholastic ability, achievement, and verbal intelligence was examined by Zurcher (101), Costin (14), and Ehrlich (24). Zurcher found in a study involving 517 college freshman and sophomores that dogmatism was negatively related to intelligence with a low order but significant correlation coefficient of minus .18. Costin correlated dogmatism with an achievement test in psychology and with the School and College Ability Test and derived coefficients of -.15 and -.11 respectively. Ehrlich used a similar design involving the Dogmatism Scale, SCAT, and an achievement test in sociology. He found a significant low order correlation of -.28 between SCAT and the scale, and a moderate negative correlation of -.43 between the achievement test and the scale. From this data it can be concluded that the Dogmatism Scale measures factors different from those measured by intelligence tests, tests of scholastic ability and achievement tests.

Criterion of Academic Ability

Form 2A, of the School and College Ability Test, was selected to control statistically for the scholastic ability of the students in this study. The test was administered to all applicants for Project Prometheus in April, 1967, one week prior to selection of the Promethean Scholars. Scores on this test were not available for
selection purposes and did not influence the selection procedure. The decision to measure scholastic ability of all applicants was prompted by the recognized need to have a common measure of scholastic ability to use as a covariance control. It was decided not to attempt to use test scores from student records because of the incompleteness of those records and the multiplicity of different tests administered at various times in the academic careers of the students.

Factors that influenced the selection of SCAT as a control for academic ability were: (a) its wide general use, (b) the availability of the test to the investigator, and (c) the relatively short administration time of the test. The single testing session lasted approximately 95 minutes. The combined verbal and quantitative scores for each student were used as covariance control for scholastic ability.

**Criterion of Intelligence**

The IPAT, *Culture Fair Intelligence Test, Scale 3*, was selected to control statistically for the intelligence of the students who participated in this investigation. The test was administered at the same testing times, places, and to the same subjects as was described for the *School and College Ability Test*. Scores were not made available for selection purposes and had no influence on selection procedures for participation in Project Prometheus.

It was decided to test all applicants at one time, using a single
measure, when it became apparent that the intelligence test scores included in the students' records represented 10 to 12 different measures administered at widely separated times in each individual student's school career. As a result of this testing, a common measure of intelligence was available to use as a covariance control.

The selection of the Culture Fair Intelligence Test was based upon a need for a measure of general intelligence that was uncontaminated by the accidental circumstances of better or poorer local schooling or social class, and free from scholastic bias and culture bound language or pictures. It was felt that such a measure would give the greatest degree of statistical control over differences in general intelligence. In his discussion of the test for the 4th Mental-
Measurements Yearbook, Drake states (17, p. 401):

In view of the fact that (a) school training would have practically no direct influence on the Cattell scores and yet the Cattell correlates higher (on the average) than the Otis with school success and (b) that the Cattell correlates on the average of .73 with other recognized tests of general ability, it would appear that a test which is almost culture-free has many advantages over the culture-bound tests. Its advantages should be recognized as a possible way of equating all subjects for past subject-matter-training effects and thus obtaining a more accurate score representing each subject's innate ability.

Another apparent advantage of using the Culture Fair Intelligence Test is that the measure involves four different subtests that have about equal inter-correlations and substantial general intelligence factor saturation. The four subtests include (9, p. 17):
In this way the test avoids the heavy contamination with one specific factor that a test constructed of but one type of task is likely to produce.

Test-retest reliabilities are reported (9, p. 16) that range between .71 and .94, with split half reliability coefficients of .82 to .59. Primary evidence of the validity of the measure is found in the direct correlation of the subtests with Thurston's second order general ability factor, or Spearman's "g" (general mental capacity) (9, p. 6). These correlations range from .53 to .99. Correlations with older tests are as listed below (9, p. 7):

| Revised Stanford-Binet | .56, .71, .85 |
| Otis                  | .73          |
| A.C.E.                | .59          |
| Wechsler Bellevue     | .84          |

In the administration of the test, both Form A and Form B were used to increase the reliability of the measure. Total time for administration was 40 minutes.

### Longitudinal Assessment Measure

In order to determine if the effects of Project Prometheus were transitory or somewhat more enduring, an attempt was made to evaluate the subjects of this study at the end of the school year that
immediately followed the termination of the project. For this purpose an evaluation form that contained the following categories was constructed:

**Understanding of Self**
- a. This student is able to estimate his own strengths and weaknesses realistically.
- b. He feels a sense of personal worth.
- c. To what extent would you describe him as "self-accepting?"

**Love of Learning**
- d. Does he place too great a value on obtaining high grades?
- e. He seems to have a "need to know."
- f. Does he seem to value learning for its own sake?

**Social Conscience**
- g. He shows regard for less bright, younger, or otherwise "different" children.
- h. He treats others with respect regardless of their status, color or creed.
- i. Is he sensitive to the feelings and needs of others?

**Tolerance for Ambiguity**
- j. Does he seem to feel comfortable with situations which may not have "right" or "wrong" answers?
- k. He is willing to make up his own mind.
- l. He is willing to consider more than one solution to a problem.

**Creative Thinking**
- m. He prefers to learn in creative ways by experimentation, inquiry, etc.
- n. There is an imaginative quality in his work.
- o. His thinking is often original or unconventional.

**Critical Thinking**
- p. He exhibits an attitude of inquiry.
- q. He has knowledge of the nature of valid inferences, abstractions, and generalizations.
- r. He uses skill in employing and applying the above attitudes and knowledge to problem solving situations.

**Leadership**
- s. He is able to accept responsibility.
- t. He is willing to accept leadership roles.
- u. He is an active leader in our school.
**Quantity and Quality of Production**

v. Do you consider his intellectual productivity adequate in quantity?

w. Disregarding the amount of work produced, do you consider it adequate in quality?

x. Do you consider the quantity and quality of his work adequate in terms of his potential?

**Response to Challenge**

y. He seems eager to perform difficult tasks.

z. He is willing to persevere in a problem situation.

aa. He seems to gear his response to the challenge itself rather than what he thinks is expected.

The evaluation form was adapted, with permission of the author, from a checklist by Paul D. Plowman, Consultant in the Education of the Mentally Gifted, California State Department of Education, which was developed for use in California Project Talent. The evaluators were asked to check one of five boxes numbered from one to five on the following basis:

1. not at all
2. somewhat
3. average
4. more than average
5. exceptionally

Responses were then added for the three statements in each category to provide a score from three to fifteen. This numerical score was used in the statistical analysis of the data.

After the evaluation forms were returned, it was noted that question d., under the topic **Love of Learning** was worded such that a high score meant the opposite of what a high score meant for the
other two questions in that section. Consequently, values for this response were reversed.

Procedures Used in Collecting the Data

Obtaining School and College Ability Test, and Culture Fair Intelligence Test Scores

The School and College Ability Test, Form 2A, and the Culture Fair Intelligence Test, Scale 3 were administered to all applicants for the 1967 session of Project Prometheus within the week of April 18th to the 22nd. Mr. Robert Casebeer, the director of Project Prometheus and Mr. Ronald Lamb, the research coordinator of the program administered all tests according to directions given with the test booklets or in manuals provided by the publisher. The tests were given at 11 centers located within the boundaries of the seven southwestern Oregon counties. Transportation to the centers was provided by the participating schools. The following is a list of test sites utilized in this study:

Coos County: Marshfield Senior High School, Coos Bay, Oregon
Curry County: Gold Beach High School, Gold Beach, Oregon
Douglas County: Douglas County Court House, Roseburg, Oregon

Douglas High School, Winston, Oregon
The Watson-Glaser Critical Thinking Appraisal, Form YM, the Torrance Tests of Creative Thinking, Form A, the Dogmatism Scale, Form E, and the Test of Behavioral Rigidity were administered to Promethean Scholars and Promethean Alternates in the first week in October, 1967. The tests were given to all junior and senior students who applied for Project Prometheus the previous spring. They were administered by the director and the research coordinator of the project. Testing sites and transportation for the subjects were provided in the same manner as for the testing sessions as described above. The tests were administered according to directions provided with the test booklets or in the manuals provided by the publishers.
Obtaining Longitudinal Assessment

The evaluation forms were mailed to the high schools that participated in the project during the month of April, 1968. The schools were asked to distribute the forms to the junior and senior English teachers so that all of the students in both experimental and control groups were rated by the same teachers in the same classes within the respective schools. A list of names was supplied each selected teacher, but no attempt was made to identify the students as to whether they had participated in the program or not.

Statistics Utilized in Analysis of Data

Two groups consisting of Promethean Scholars and Promethean Alternates for the 1967 session of Project Prometheus were evaluated during the summer of 1967 and the following academic year with respect to critical thinking abilities, creative thinking abilities, behavioral rigidity, and dogmatism.

Academic ability was measured by the School and College Ability Test administered to both groups prior to the beginning of the 1967 session. The total converted score was computed for each student. This score was used to control for student differences in academic ability in tests of the null hypotheses.

Intelligence was measured by the Culture Fair Intelligence Test.
administered to both groups at the same testing session at which the 
SCAT was administered. Total raw scores were computed for each 
student. This score was used to control for student differences in 
intelligence in tests of the null hypotheses.

Critical thinking abilities were assessed by the Watson-Glaser 
Critical Thinking Appraisal, Form YM. Total raw scores were com-
puted for each student and were used in the analysis of data.

Creative thinking abilities were assessed by the Torrance Tests 
of Creative Thinking. Due to the unique nature of the tests, the 
completed test booklets were shipped to the publisher for grading by 
professionally trained scorers. Data received back from the pub-
lisher included raw scores and standard scores for each of the four 
figural factors and for each of the three verbal factors. Standard 
scores were selected for use in the analysis of data. In addition, 
mean standard scores of the combined figural tests and the combined 
verbal tests were computed. The sum of the figural and verbal 
means was computed to give a mean total creative thinking score.

The Test of Behavioral Rigidity was utilized to assess relative 
behavioral flexibility-rigidity. Standard scores for each of the three 
factors were computed and summed to provide a composite factor 
score for the purpose of this analysis.

Dogmatism was assessed by the Dogmatism Scale, Form E. 
Responses were added algebraically and then added to a constant of
The resulting score was utilized in this analysis.

Longitudinal assessment was accomplished by use of an evaluation form that was administered in April 1968, nine months after the end of the 1967 session of Project Prometheus. Total raw scores for each of the nine factors were computed for use in the analysis of data.

Group means were used as the unit of analysis for all measures, since it was the groups that were or were not subjected to the experimental program. Coefficients of correlation between each of the test scores were calculated for the Promethean Scholars and Promethean Alternates.

In the tests of the null hypotheses, means of Promethean Scholars for each of the criterion tests were compared to means of Promethean alternates. Since scores on such tests are usually correlated with academic ability and intelligence, and since a certain amount of selection bias based on various measures of intelligence and academic ability may have entered the procedures used to select the Promethean Scholars, a suitable design is a single classification analysis of covariance utilizing academic ability and intelligence as covariance controls. Wert states that (95, p. 343):

... if groups are to be compared on the basis of their response to a criterion, and if individual differences among the members within the groups are either known to influence the criterion or suspected of such influence, an attempt must be made to control those individual differences.

... to provide the investigator with a means of attaining
a measure of control of individual differences, the statistical technique known as **analysis of covariance** was developed.

... In general it will provide tests of significance for the comparison groups whose members may have been stratified and whose members have been measured with regard to one or more variable characteristics other than the criterion.

The investigator received advice from Dr. Walter Lonner, faculty member of the Science Education Department of Oregon State University, concerning the statistical design of this study.

**Processing of the Data**

Data from the various sources were tabulated on programming sheets then punched on IBM cards for analysis. Using the statistical design cited in the previous section, a suitable computer program was selected with the aid of the Oregon State University Computer Center. The program was designed to compute means, standard deviations, coefficients of correlation and F ratios used in this study.

The program selected was the BMDO5V - General Linear Hypothesis, and was computed at the Health Sciences Computing Facility of the University of California at Los Angeles.

A table (95, p. 419) giving the five and one percent values of F ratios was consulted to determine the level of significance of differences of group means on criterion tests.
IV. PRESENTATION AND INTERPRETATION OF THE FINDINGS

This investigation was undertaken to determine the effects upon able and gifted high school students from southwestern Oregon of a residential summer school known as Project Prometheus. The project was designed to provide an interwoven matrix of inter-disciplinary concepts and experiences over an intensive six week period. Of specific interest in the investigation were the attainment of critical and creative thinking abilities, and the reduction in dogmatism and behavioral rigidity. Those students who attended, referred to as Promethean Scholars, were compared to a group of like ability, referred to as Promethean Alternates, who did not attend the project. The study was conducted on the campus of Southern Oregon College during the summer session of 1967 and at the various participating high schools during the 1967-1968 academic year. The subjects were able and gifted juniors and seniors from the 48 high schools in the seven southwestern Oregon counties.

Data for this investigation were obtained through: (a) administering the School and College Ability Test, Form 2A, and the Culture Fair Intelligence Test, Scale 3, in April, 1967 to establish covariance controls, (b) administration of the instruments selected to measure aspects of critical and creative thinking, dogmatism and behavioral
rigidity, after the program in October 1967, and (c) administration of the teacher evaluation form in April 1968 to determine the long range effects of the program. Data from all tests and the evaluation form were tabulated on data sheets and punched on IBM cards for statistical analysis.

The data collected in this investigation were used to compare group means, standard deviations and correlations between criterion test scores and several variables for each group and to test the null hypotheses listed in Chapter I. Group means were used as the unit of analysis in the testing of null hypotheses since it was the groups, rather than individuals, that were being compared.

The statistical model employed was the single classification analysis of covariance. The criterion measure in each of the tests of the null hypotheses was the group mean on the Watson-Glaser Critical Thinking Appraisal, Form YM, the Torrance Tests of Creative Thinking, the Dogmatism Scale, Form E, the Test of Behavioral Rigidity, and the nine aspects represented on the teacher evaluation form. The covariance controls were group means on the School and College Ability Test, Form 2A, and the Culture Fair Intelligence Test, Scale 3.
Analysis of the Data

While the primary concern of this study was the effect of Project Prometheus on the development of critical and creative thinking abilities and the reduction of dogmatism and behavioral rigidity of able and gifted high school students, the investigator felt that it was important to examine several other variables to determine the nature of the group under investigation.

Since it was known that measures of academic ability and intelligence were to be used as criteria for application and selection for Project Prometheus, and as it was hypothesized that these factors are related to scores on the criterion measures, these variables were examined by means of testing prior to selection for the program.

Scores of Academic Ability

Table 2 provides information concerning the two groups based upon scores of academic ability.

Table 2. Mean School and College Ability Test (SCAT) scores and mid-percentile ranks of Promethean Scholars and Promethean Alternates

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>SCAT Mean</th>
<th>S. D.</th>
<th>Mid-percentile rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>312.46</td>
<td>8.49</td>
<td>98</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>308.07</td>
<td>8.83</td>
<td>96</td>
</tr>
</tbody>
</table>
The Promethean Scholars averaged slightly higher than did the Promethean Alternates in the total score on the School and College Ability Test (Table 2). Comparisons with the grade 11 norm group (22, p. 41) indicate that the Promethean Scholars ranked in the 98th percentile nationwide and Promethean Alternates ranked in the 96th percentile. The SCAT standard deviations were approximately equal and relatively small, indicating that both groups were relatively homogeneous with respect to scholastic ability.

Scores of Intelligence

The following table (Table 3) provides information regarding the nature of the sample based upon scores of intelligence.

Table 3. Mean Culture Fair Intelligence Test (CFIT) scores and I.Q. equivalents of Promethean Scholars and Promethean Alternates.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Culture Fair Raw Score</th>
<th>Culture Fair I.Q. Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Promethean Scholar</td>
<td>185</td>
<td>60.54</td>
<td>6.60</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>59.69</td>
<td>6.50</td>
</tr>
</tbody>
</table>

The Promethean Scholars averaged slightly higher than did the Promethean Alternates in the total raw score on the Culture Fair Intelligence Test (Table 3). Transformation of these scores into I.Q.
equivalents (9, p. 48) yielded a culture-fair intelligence quotient of 129 for the Promethean Scholars and 128 for the Promethean Alternates. Standard deviations for the test were approximately equal and relatively small for both groups, again indicated that the Promethean Scholars and the Promethean Alternates were relatively homogeneous with respect to intelligence.

The preceding information provided evidence that the two groups represented samples of a population that can be classified as able and gifted on the basis of being in the upper 10 percent of the nationwide population of high school students on measures of academic ability and intelligence (35, 47).

Critical Thinking Ability of Students

The critical thinking ability of the students was measured by scores on the Watson-Glaser Critical Thinking Appraisal, Form YM. Total means, standard deviations, percentile ranks, and stanines for the Promethean Scholars and Promethean Alternates are shown in Table 4. Both groups showed scores that were ranked in the 7th stanine based upon total raw scores for grade 11 norm groups. In terms of broad classification, stanine 7 is regarded as indicating above average critical thinking ability (94, p. 7). A comparison of means and percentile ranks indicates that Promethean Scholars were slightly better critical thinkers than the Promethean Alternates, with
the scholars ranking in the 88th percentile based on 11th grade norms and alternates ranking in the 84th percentile.

Table 4. Mean scores, standard deviations, percentile ranks and stanines of Promethean Scholars and Promethean Alternates based upon the Watson-Glaser Critical Thinking Appraisal, Form YM (WGCTA).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S. D.</th>
<th>Percentile rank*</th>
<th>Stanine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>77.71</td>
<td>8.07</td>
<td>88</td>
<td>7</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>75.08</td>
<td>7.29</td>
<td>84</td>
<td>7</td>
</tr>
</tbody>
</table>

* Based upon total raw scores for grade 11.

A comparison of the students' critical thinking abilities and their intelligence quotients indicates close agreement with relationships reported by Watson (94). Promethean Scholars scored in the 88th percentile rank on the Watson-Glaser Critical Thinking Appraisal and established an I. Q. equivalent of 129 on the Culture Fair Intelligence Test, while Promethean Alternates scored in the 84th percentile rank and established an I. Q. equivalent of 128. On the basis of grade 11 norms, Watson (94, p. 6) indicates that percentile ranks 88 and 84 on the appraisal correspond to Otis Gamma I. Q. 's of 127 and 125 respectively.

A comparison of the standard deviations of the WGCTA scores revealed that the scores for the Promethean Scholars varied slightly
more than did those of the Promethean Alternates.

Coefficients of correlation between criterion test scores and scores on the covariance control measures for students in each group are shown in Table 5. To determine whether the correlations were statistically significant, a table of r at the five and one percent levels of significance was consulted (95, p. 424).

Positive correlations were observed between WGCTA scores and SCAT, CFIT, and TBR scores in that order of magnitude. Correlations between WGCTA and CFIT scores and between WGCTA and SCAT scores were significant at the one percent level of confidence for both groups. Correlations between WGCTA scores and TBR scores were significant at the one percent level for Promethean Scholars and at the five percent level for Promethean Alternates. Negative correlations were observed between WGCTA scores and scores on the Dogmatism Scale for both groups. Both negative correlations were significant; however, that for Promethean scholars was at the one percent level while the correlation was significant at the five percent level for Promethean Alternates. Neither of the group correlations between WGCTA scores and total scores on the Torrance Tests of Creative Thinking were significant.
Table 5. Correlations between individual scores on the criterion measures for Promethean Scholars and Promethean Alternates.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Criterion Test</th>
<th>SCAT Total</th>
<th>CFIT</th>
<th>DS</th>
<th>TBR</th>
<th>TTCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>WGCTA</td>
<td>.54**</td>
<td>.34**</td>
<td>-0.24**</td>
<td>.30**</td>
<td>.04</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>WGCTA</td>
<td>.41**</td>
<td>.32**</td>
<td>0.15*</td>
<td>.16*</td>
<td>.09</td>
</tr>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>TTCT</td>
<td>.05</td>
<td>.05</td>
<td>.11</td>
<td>.13</td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>TTCT</td>
<td>-0.07</td>
<td>.02</td>
<td>-0.03</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>TBR</td>
<td>.20**</td>
<td>.27**</td>
<td>-0.18*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>TBR</td>
<td>.23**</td>
<td>.10</td>
<td>-0.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>DS</td>
<td>-0.21**</td>
<td>-0.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>DS</td>
<td>-0.13</td>
<td>-0.02</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Indicates that the correlation is significant at the five percent level
** Indicates that the correlation is significant at the one percent level

WGCTA - Watson-Glaser Critical Thinking Appraisal
TTCT - Torrance Tests of Creative Thinking
TBR - Test of Behavioral Rigidity
DS - Dogmatism Scale
CFIT - Culture Fair Intelligence Test
Creative Thinking Ability of Students

The creative thinking ability of the students was measured by scores on the Torrance Tests of Creative Thinking, Form A. The total means and standard deviations of the test results for Promethean Scholars and Promethean Alternates are shown in Table 6, together with converted T score means for the eleventh grade norm group (92, p. 66). Standard deviations for the norm group are not given, as raw scores were converted to T scores for comparison purposes and the standard deviations given in the norm-technical manual (92) are for raw scores. The investigator used T scores rather than raw scores in this study to facilitate the computation of a composite verbal and figural score and a total creativity score as is recommended in the norms-technical manual (92, p. 71).

A close examination of Table 6 indicates that there is a marked similarity between the scores of Promethean Scholars and Promethean Alternates. The rather small differences favor the Promethean Scholars on six of the seven sub-factors and the three composite factors.

A comparison of the Promethean Scholars and the Promethean Alternates with the eleventh grade norm group shows the overall general superiority in creative thinking abilities of the two groups represented in this study. Differences between the means of
Table 6. Mean T scores and standard deviations of Promethean Scholars, Promethean Alternates and the 11th grade norm group based upon the Torrance Tests of Creative Thinking.

<table>
<thead>
<tr>
<th>Creative Thinking Tests</th>
<th>Promethean Scholars Mean</th>
<th>S. D.</th>
<th>Promethean Alternates Mean</th>
<th>S. D.</th>
<th>Eleventh Grade Norm Group Mean</th>
<th>S. D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figural Fluency</td>
<td>41.52</td>
<td>8.64</td>
<td>40.81</td>
<td>8.73</td>
<td>37.76</td>
<td>**</td>
</tr>
<tr>
<td>Figural Flexibility</td>
<td>46.54</td>
<td>8.64</td>
<td>45.88</td>
<td>8.76</td>
<td>42.00</td>
<td></td>
</tr>
<tr>
<td>Figural Originality</td>
<td>46.48</td>
<td>12.16</td>
<td>43.15</td>
<td>11.64</td>
<td>44.50</td>
<td></td>
</tr>
<tr>
<td>Figural Elaboration</td>
<td>68.99</td>
<td>14.96</td>
<td>66.10</td>
<td>14.17</td>
<td>39.50</td>
<td></td>
</tr>
<tr>
<td>Total Figural</td>
<td>51.02</td>
<td>9.10</td>
<td>48.83</td>
<td>8.76</td>
<td>40.69</td>
<td></td>
</tr>
<tr>
<td>Total Verbal Fluency</td>
<td>58.24</td>
<td>10.95</td>
<td>56.39</td>
<td>10.35</td>
<td>51.50</td>
<td></td>
</tr>
<tr>
<td>Total Verbal Flexibility</td>
<td>72.09</td>
<td>11.61</td>
<td>69.46</td>
<td>11.94</td>
<td>57.37</td>
<td></td>
</tr>
<tr>
<td>Total Verbal Originality</td>
<td>48.90</td>
<td>7.48</td>
<td>49.10</td>
<td>7.29</td>
<td>47.58</td>
<td></td>
</tr>
<tr>
<td>Total Verbal</td>
<td>59.16</td>
<td>8.66</td>
<td>58.01</td>
<td>8.75</td>
<td>54.15</td>
<td></td>
</tr>
<tr>
<td>Total Creative Thinking</td>
<td>109.66</td>
<td>14.39</td>
<td>106.27</td>
<td>13.74</td>
<td>94.84</td>
<td></td>
</tr>
</tbody>
</table>

* based upon 64 eleventh grade students in a California high school (92, p. 66).

** standard deviations for norm group not available for T scores.
Promethean Scholars and the norm group favor the experimental group in all seven sub-factors and the three composite factors, with the largest differences showing up in the sub-factors of verbal fluency (14.65) and figural elaboration (29.49).

High scores in verbal flexibility represent the ability to produce a large variety of kinds of ideas and to be able to shift from one strategy or approach to another. Torrance (92, p. 73) indicates that one would expect a person high in verbal flexibility to have high motivation, a broad range of experiences and information, and a surplus of intellectual energy.

A high score on figural elaboration represents the ability to develop, embellish, carry out, or otherwise elaborate ideas. Torrance states that (92, p. 75), "High scores seem, among other things, to be associated with keenness or sensitivity in observation."

The same general relationship that existed between Promethean Scholars and the norm group also exists between scores of the norm group and those of the Promethean Alternates. However, the differences are not of as great a magnitude. The norm group scored slightly higher than the Promethean Alternates in figural originality.

On the basis of the comparisons with the eleventh grade norm group, this investigator concluded that the mean creative thinking abilities of students who participated in this study were superior to the mean creative thinking abilities of groups of high school
sophomores and juniors who did not participate, especially in areas of verbal fluency and figural elaboration. The reader is reminded, however, that the norm group represents a random sample of the entire junior class in a high school while the two groups in this study represent a population of students from the upper ten percent of the sophomore and junior classes, who were motivated enough to apply for Project Prometheus.

Coefficients of correlation between the Torrance Tests of Creative Thinking and each of several variables for students in each of the participating groups are included in Table 5. A table of the one and five percent levels of significance (95, p. 424) was consulted in order to determine if the correlations were statistically significant.

Correlations were observed to be highest between TTCT scores and TBR scores for both groups, however, neither correlation was significant at the five percent level of confidence. Negative, but non-significant correlations were observed between TTCT scores and both SCAT and DS scores for the Promethean Alternates.

Behavioral Rigidity of Students

The behavioral rigidity of the students was measured by scores on the Test of Behavioral Rigidity. The total means and standard deviations of the test results and composite rigidity quotients for the Promethean Scholars and Promethean Alternates are given in Table 7.
A high score on the rigidity variable indicates a score in the flexible direction, and a low score indicates rigid behavior. A comparison of the composite rigidity quotients of the two groups shows a difference in the flexible direction, favoring the Promethean Scholars.

Table 7. Means, standard deviations and composite rigidity quotients of Promethean Scholars and Promethean Alternates based upon the Test of Behavioral Rigidity (TBR).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S. D.</th>
<th>Composite Rigidity Quotient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>166.24</td>
<td>12.24</td>
<td>104.64</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>162.48</td>
<td>11.80</td>
<td>100.48</td>
</tr>
</tbody>
</table>

For purposes of comparing behavioral rigidity of the students in this study with the behavioral rigidity of the norm groups, composite rigidity quotients were compared to the following classification scheme constructed by Schaie on the basis of a sample consisting of 500 individuals selected at random from a population described as, "... reasonably representative of the broad middle group of our population" (81, p. 10). . .

- 69 or below - very rigid
- 70 - 79 - rigid
- 80 - 89 - moderately rigid
- 90 - 109 - average
- 110 - 119 - moderately flexible
- 120 - 129 - flexible
- 130 or above - very flexible
Both groups fell within the range classified as "average." As Schaie (81) has shown that systematic age changes on all the rigidity dimensions progress in a rigid direction with increase in age, a more precise comparison can be made by examining the mean composite rigidity quotient of the norm subgroup that most nearly approximates the age group represented by the subjects in this investigation. The mean composite rigidity quotient of the subgroup represented by 25 men and 25 women ranging in age from 20 to 25 years was 100.24 (81, p. 11). Table 7 shows that the mean composite rigidity quotients of the Promethean Scholars and Promethean Alternates were 104.64 and 100.48 respectively. This indicates that the Promethean Alternates were about equal to the norm sub group while the Promethean Scholars were somewhat more flexible. It should be noted however, that the mean age of the subjects in this investigation was 16 years 6 months for the Promethean Scholars and 16 years 5 months for the Promethean Alternates. If the age changes in rigidity found by Schaie are continuous over all age groups it should be expected that the younger age group would score higher on the Test of Behavioral Rigidity.

Coefficients of correlation between Test of Behavioral Rigidity scores and each of several variables for students in both participating groups are shown in Table 5.

TBR scores showed positive correlations, significant at the one
percent level, to SCAT, CFIT and WGCTA scores for Promethean Scholars. The only positive correlation significant at the one percent level for Promethean Alternates was between TBR scores and SCAT scores.

Positive correlations, significant at the five percent level were noted between TBR scores and WGCTA scores for Promethean Alternates.

Negative correlations were noted between TBR scores and DS scores for both groups. However, the only negative correlation which was significant at the five percent level was for the Promethean Scholars.

There were no significant correlations between TBR scores and TTCT scores for either participating group.

Dogmatism of Students

The dogmatism, or open-closed-mindedness of the students was measured by scores on the Dogmatism Scale. Means and standard deviations for Promethean Scholars and Promethean Alternates are shown in Table 8. Scoring was on the basis of positive weights for agree answers and negative weights for disagree answers, as indicated in Chapter III. Raw scores were added to a constant of 160. A score above 160 indicates closed-mindedness and a score below 160 indicates open-mindedness.
Table 8. Means and standard deviations of Promethean Scholars and Promethean Alternates based upon the Dogmatism Scale, Form E.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Dogmatism Mean</th>
<th>S. D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>148.22</td>
<td>22.63</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>151.04</td>
<td>23.76</td>
</tr>
</tbody>
</table>

Each group scored well below 160, indicating that the parent population from which the samples were selected was relatively open-minded. The Promethean Scholars scored 3.18 points lower than the Promethean Alternates and showed a slightly greater degree of homogeneity as indicated by the standard deviations.

Rokeach's norm groups for the Dogmatism Scale, Form E (75, p. 90) consist of college students and adult groups from different ethnic and political persuasions. The norm group that most closely approximates the background and age of the two groups in this study consists of 50 college freshmen and sophomores from Ohio State University. Mean score for this norm group was 143. A comparison of this score with scores shown in Table 8 indicates that the norm group was somewhat more open-minded than the groups used in this study.

A more meaningful comparison can be made by utilizing the results of Sorenson's study involving 597 high school sophomores.
from the Salt Lake City School District (87, p. 87). Based on data secured at the end of an experimental program utilizing different methods of teaching biology, Sorenson found that a group of 288 students who were exposed to a laboratory centered program obtained a mean score of 161.92 on the Dogmatism Scale, Form E. A similar group exposed to a lecture-demonstration program obtained a mean score of 168.41. A further analysis of Sorenson's data shows that when students were stratified by I.Q. the groups that most closely resemble the two Promethean groups, those with an I.Q. of 120 and above, obtained scores of 149.37 for the laboratory centered group and 149.0 for the lecture-demonstration group. Scores for Promethean Scholars and Promethean Alternates are in close agreement with these findings.

The results of this test indicate that both groups in this study were relatively open-minded.

Coefficients of correlation between the Dogmatism Scale and each of several variables for Promethean Scholars and Promethean Alternates are shown in Table 5.

With the exception of a non-significant positive correlation between DS scores and TTCT scores, all correlations were negative. Negative correlations, significant at the one percent level, for Promethean Scholars were noted between DS scores and scores on WGCTA and SCAT. A negative correlation, significant at the five
percent level for Promethean Scholars was noted between DS scores and TBR scores.

The only negative correlation, significant at either the five or one percent level for Promethean Alternates was for DS scores and WGCTA scores. The reader should note that scores in a favorable direction increase for all measures used in this study with the exception of the Dogmatism Scale.

Tests of Null Hypotheses

In the tests of the null hypotheses the statistical model employed was the single classification analysis of covariance recommended by Wert (95, p. 344). Group means were used as the unit of analysis, since it was group differences rather than individual differences that were being tested. Criterion instruments used in the investigation were the Watson-Glaser Critical Thinking Appraisal, Form YM, the Torrance Tests of Creativity, the Test of Behavioral Rigidity, the Dogmatism Scale, Form F, and the teacher evaluation form constructed for the longitudinal assessment of Project Prometheus.

The group means of the School and College Ability Test, Form 2A, and the Culture Fair Intelligence Test were applied as covariance controls to the criterion group means.

Analysis of data and computation of F ratios were carried out
at the Health Sciences Computing Facility of the University of California at Los Angeles utilizing the program entitled, BMDO5V-General Linear Hypothesis. F ratios were evaluated by consulting a Table of the five and one percent values of F (95, p. 419).

In this section, tests of null hypotheses which were stated in Chapter I are presented and discussed.

1. **There Is No Difference in Critical Thinking Ability Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated.**

   The results of the critical thinking test scores for Promethean Scholars and Promethean Alternates are shown in Table 9. Both groups showed mean scores considerably higher than the norm groups. The Promethean Scholars scored 2.63 points higher than the Promethean Alternates.

   The F ratio of 77.07 indicated that the difference in group means on the Watson-Glaser Critical Thinking Appraisal, Form YM, when adjusted for individual differences in scholastic ability and intelligence, was significant beyond the .01 level. Hence, the null hypothesis was rejected, indicating a real difference between the two groups in critical thinking abilities as measured by the Watson-Glaser Critical Thinking Appraisal, Form YM.
Table 9. Relationship of critical thinking ability of Promethean Scholars to that of Promethean Alternates as measured by the Watson-Glaser Critical Thinking Appraisal.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>WGCTA Mean</th>
<th>S.D.</th>
<th>SCAT Mean</th>
<th>CRIT Mean</th>
<th>df</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>77.71</td>
<td>8.07</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>75.08</td>
<td>7.29</td>
<td>308.07</td>
<td>59.69</td>
<td></td>
<td>2,431</td>
<td>77.074</td>
</tr>
</tbody>
</table>

2. There Is No Difference in Creative Thinking Ability Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated.

The results of the creative thinking test scores for Promethean Scholars and Promethean Alternates are shown in Table 10. Group means were compared, and when adjusted for individual differences in scholastic ability and intelligence, indicated an F ratio (.4165) too small to be significant at the .01 or .05 level of confidence. Further analysis indicated no significant differences on any of the seven subtest scores used in compiling the composite creative thinking score. Hence, the null hypothesis of no difference based on the Torrance Tests of Creative Thinking, Form A was accepted.
Table 10. Relationship of creative thinking abilities of Promethean Scholars to that of Promethean Alternates as measured by the Torrance Tests of Creative Thinking.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>TTCT Mean</th>
<th>S.D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>df</th>
<th>F</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>109.66</td>
<td>14.39</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>106.27</td>
<td>13.74</td>
<td>308.07</td>
<td>59.69</td>
<td>2,431</td>
<td>.4165</td>
<td>N. S.</td>
</tr>
</tbody>
</table>

3. There Is No Difference in Behavioral Rigidity Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated.

The results of the behavioral rigidity scores for the two groups are found in Table 11. Mean scores of the Promethean Scholars were compared to the mean scores of the Promethean Alternates. The F ratio of 13.916 indicated that the difference in group means on the Test of Behavioral Rigidity, when adjusted for individual differences in scholastic ability and intelligence, was significant beyond the .01 level. Hence, the null hypothesis was rejected, indicating a real difference between the two groups in behavioral rigidity as measured by the Test of Behavioral Rigidity.
Table 11. Relationship of behavioral rigidity of Promethean Scholars to that of Promethean Alternates as measured by the Test of Behavioral Rigidity.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>TBR Mean</th>
<th>S.D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>ndf</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>166.24</td>
<td>12.24</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>162.48</td>
<td>11.80</td>
<td>308.07</td>
<td>59.69</td>
<td>2,431</td>
<td>13.916</td>
<td>.01</td>
</tr>
</tbody>
</table>

4. There Is No Difference in Dogmatism Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated.

The results of the dogmatism scores for these groups are found in Table 12. The means of the Promethean Scholars were compared to the mean scores of the Promethean Alternates. The F ratio of 5.874 indicated that the difference in group means on the Dogmatism Scale, Form E, when adjusted for individual differences in scholastic ability and intelligence was significant beyond the .01 level. Hence, the null hypothesis was rejected, indicating a real difference between the two groups in dogmatism as measured by the Dogmatism Scale, Form E.
Table 12. Relationship of dogmatism of Promethean Scholars to that of Promethean Alternates as measured by the Dogmatism Scale.

<table>
<thead>
<tr>
<th>Group</th>
<th>Dogmatism N</th>
<th>Mean</th>
<th>S. D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>ndf</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>148.22</td>
<td>22.62</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>151.04</td>
<td>23.76</td>
<td>308.07</td>
<td>59.69</td>
<td>2431</td>
<td>5.874</td>
<td>.01</td>
</tr>
</tbody>
</table>

5a. There Is No Difference in Critical Thinking Abilities Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluations One Year After Termination of the Project.

The results of the evaluation scores for Promethean Scholars and Promethean Alternates are found in Table 13. The means of the two groups were compared. Promethean Scholars had a mean score 1.15 points higher than the mean for Promethean Alternates. When the means were adjusted for individual differences in academic ability and intelligence the difference was found to be significant beyond the .01 level. Hence, the null hypothesis was rejected, indicating a real difference between the two groups in critical thinking ability as measured by the teacher evaluation form administered one school year after termination of the project year.
Table 13. Relationship of critical thinking abilities of Promethean Scholars to that of Promethean Alternates as measured by the teacher evaluation form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Critical Thinking Mean</th>
<th>S.D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>ndf</th>
<th>F</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>11.99</td>
<td>2.19</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>10.84</td>
<td>2.25</td>
<td>308.07</td>
<td>59.69</td>
<td>2431</td>
<td>10.028</td>
<td>.01</td>
</tr>
</tbody>
</table>

Coefficients of correlation between scores for Critical Thinking on the teacher evaluation form and total scores on the Watson-Glaser Critical Thinking Appraisal, Form YM for both groups are found in Table 14. A table of values of r at the .05 and .01 levels of significance (95, p. 424) was consulted in order to determine the significance of the computed correlations.

Correlations were significant at the .01 level for Promethean Scholars and non-significant for Promethean Alternates.

Table 14. Correlation between scores on the Watson-Glaser Critical Thinking Appraisal, Form YM, and evaluation of critical thinking abilities as measured by the teacher evaluation form for Promethean Scholars and Promethean Alternates.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Criterion Test</th>
<th>Teacher Evaluation of Critical Thinking</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>WGCTA</td>
<td>.25153</td>
<td>.01</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>WGCTA</td>
<td>.10568</td>
<td>N.S.</td>
</tr>
</tbody>
</table>
5b. There Is No Difference in Creative Thinking Abilities Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluations One Year After Termination of the Project.

The results of the evaluation scores for both groups are found in Table 15. For comparison, the means of the two groups were adjusted for individual differences in scholastic ability and intelligence. The difference between the means for Creative Thinking as measured by the teacher evaluation form was found to be significant beyond the .01 level. Consequently the null hypothesis was rejected.

Table 15. Relationship of creative thinking ability of Promethean Scholars to that of Promethean Alternates as measured by the teacher evaluation form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Creative Thinking Mean</th>
<th>S.D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>df</th>
<th>F</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>11.78</td>
<td>2.42</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>10.64</td>
<td>2.46</td>
<td>308.07</td>
<td>59.69</td>
<td>2.431</td>
<td>9.470</td>
<td>.01</td>
</tr>
</tbody>
</table>

Coefficients of correlation between creative thinking scores on the teacher evaluation form and subtests and total scores on the Torrance Tests of Creative Thinking are shown in Table 16. A table of values of r at the .05 and .01 levels of significance (95, p. 424) was consulted in order to determine whether the computed correlations were statistically significant.

While the questions in the evaluation form were constructed on
Table 16. Correlations between scores on the Torrance Tests of Creative Thinking and evaluations of creative thinking abilities as measured by the teacher evaluation form for Promethean Scholars and Promethean Alternates.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Evaluation Form Criteria</th>
<th>Verbal Fluency</th>
<th>Verbal Flexibility</th>
<th>Verbal Originality</th>
<th>Figural Fluency</th>
<th>Figural Flexibility</th>
<th>Figural Originality</th>
<th>Figural Elaboration</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>Creative Thinking</td>
<td>-0.01</td>
<td>-0.07</td>
<td>-0.01</td>
<td>-0.02</td>
<td>.04</td>
<td>.09</td>
<td>.12</td>
<td>.03</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>Creative Thinking</td>
<td>.07</td>
<td>.14</td>
<td>.04</td>
<td>-0.10</td>
<td>-0.09</td>
<td>-0.04</td>
<td>.04</td>
<td>.05</td>
</tr>
</tbody>
</table>
the basis of the teacher evaluations of creative thinking given by Torrance in the norms-technical manual (92, p. 88) for the TTCT, there were no significant correlations between any of the scores on the test given at the end of the project and scores on the evaluation form completed nine months later at the individual high schools. This lack of a significant correlation coupled with the fact that there was a significant difference between the groups on the basis of the teacher evaluation form but no significant difference on any of the factors measured by the Torrance Tests of Creative Thinking indicates that the test and the classroom teachers may be identifying different aspects of creative thinking.

5c. **There Is No Difference in Understanding of Self Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluations One Year After Termination of the Project.**

The results of the evaluation scores for Promethean Scholars and Promethean Alternates are found in Table 17. The means of the two groups were compared. Promethean Scholars had a mean score .47 points higher than the mean score for Promethean Alternates. When the means were adjusted for individual differences in academic ability and intelligence, the obtained F ratio (2.784) did not indicate any significant difference in Understanding of Self between the two
groups based upon the scores from the teacher evaluation form.

Hence, the null hypothesis was accepted.

Table 17. Relationship of Understanding of Self of Promethean Scholars to that of Promethean Alternates as measured by the teacher evaluation form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S, D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>ndf</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>11.68</td>
<td>2.35</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>11.21</td>
<td>1.93</td>
<td>308.07</td>
<td>59.69</td>
<td>2,431</td>
<td>2.784</td>
<td>N. S.</td>
</tr>
</tbody>
</table>

5d. There Is No Difference in Love of Learning Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluations One Year After Termination of the Project.

The results of the evaluation scores for both groups are shown in Table 18. For comparison the means of the two groups were adjusted for individual differences in academic ability and intelligence.

The Promethean Scholars had a mean score .69 points higher than the mean score for Promethean Alternates. The obtained F ratio (4.570) was significant at the .05 level and indicated a real difference in Love of Learning between the Promethean Scholars and Promethean Alternates based upon scores from the teacher evaluation form.

Consequently the null hypothesis was rejected.
Table 18. Relationship of Love of Learning of Promethean Scholars to that of Promethean Alternates as measured by the teacher evaluation form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Love of Learning Mean</th>
<th>S. D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>ndf</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>11.19</td>
<td>2.17</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>10.50</td>
<td>1.87</td>
<td>308.07</td>
<td>59.69</td>
<td>2,431</td>
<td>4.570</td>
<td>.05</td>
</tr>
</tbody>
</table>

5e. There Is No Difference in Social Conscience Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluations One Year After Termination of the Project.

The results of the evaluation scores for Promethean Scholars and Promethean Alternates are found in Table 19. The means for the two groups were compared. Promethean Alternates had a mean score .14 points higher than the mean score for Promethean Scholars.

When the means were adjusted for individual differences in academic ability and intelligence, the obtained F ratio (.0433) did not indicate any significant difference in Social Conscience between the two groups based upon the scores from the teacher evaluation form. Hence, the null hypothesis was accepted.
Table 19. Relationship of Social Conscience of Promethean Scholars to that of Promethean Alternates as measured by the teacher evaluation form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Social Consience Mean</th>
<th>S.D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>F</th>
<th>Ratio</th>
<th>ndf</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>10.88</td>
<td>2.93</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>11.02</td>
<td>2.52</td>
<td>308.07</td>
<td>59.69</td>
<td>2,431</td>
<td>.0433</td>
<td>N.S.</td>
<td></td>
</tr>
</tbody>
</table>

5f. There Is No Difference in Tolerance of Ambiguity Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluations One Year After Termination of the Project.

The results of the evaluation scores for the two groups are found in Table 20. For comparison, the means of the two groups were adjusted for individual differences in academic ability and intelligence. The Promethean Scholars had a mean score .86 points higher than the mean score for Promethean Alternates. The obtained F ratio (3, 959) was significant at the .05 level and indicated a real difference in Tolerance of Ambiguity between the Promethean Scholars and Promethean Alternates based upon scores from the teacher evaluation form. Consequently, the null hypothesis was rejected.
Table 20. Relationship of Tolerance of Ambiguity of Promethean Scholars to that of Promethean Alternates as measured by the teacher evaluation form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Tolerance of Ambiguity Mean</th>
<th>S. D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>ndf</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>12.20</td>
<td>2.40</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>11.46</td>
<td>2.06</td>
<td>308.07</td>
<td>59.69</td>
<td>2,431</td>
<td>3.959</td>
<td>.05</td>
</tr>
</tbody>
</table>

Coefficients of correlation between Tolerance of Ambiguity scores on the teacher evaluation form and scores on the Dogmatism Scale, and the Test of Behavioral Rigidity are found in Table 21. A table of values of r at the .05 and .01 levels of significance (95, p. 424) was consulted in order to determine whether the computed correlations were statistically significant.

While the definition of Tolerance of Ambiguity used in this study and in the construction of the evaluation form draws heavily upon the same concepts used by the authors of the Dogmatism Scale (75), and the Test of Behavioral Rigidity (83), the correlation between the evaluation form and the TBR for Promethean Scholars was the only one significant at the .05 level.
Table 21. Correlation between scores on Tolerance of Ambiguity as measured by the teacher evaluation form and scores on the Test of Behavioral Rigidity and the Dogmatism Scale for Promethean Scholars and Promethean Alternates.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Evaluation form Criteria</th>
<th>Test of Behavioral Rigidity</th>
<th>Dogmatism Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>Tolerance of Ambiguity</td>
<td>.14838*</td>
<td>-0.0599</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>Tolerance of Ambiguity</td>
<td>.05117</td>
<td>-0.0201</td>
</tr>
</tbody>
</table>

* Indicates that the correlation is significant at the .05 level.

5g. **There Is No Difference in Leadership Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluation One Year After Termination of the Project.**

The results of the evaluation scores for Promethean Scholars and Promethean Alternates are found in Table 22. The means for the two groups were compared. Promethean Scholars had a mean score .86 points higher than the mean score for Promethean Alternates. When the means were adjusted for individual differences in academic ability and intelligence, the obtained F ratio (.6369) did not indicate any significant difference in Leadership between the groups based upon the scores from the teacher evaluation form. Hence, the null hypothesis was accepted.
Table 22. Relationship of Leadership of Promethean Scholars to that of Promethean Alternates as measured by the teacher evaluation form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Leadership Mean</th>
<th>S.D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>ndf</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>11.24</td>
<td>2.77</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td>N.S.</td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>10.38</td>
<td>2.67</td>
<td>308.07</td>
<td>59.69</td>
<td>2.431</td>
<td>.6369</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

5h. There is No Difference in Quantity and Quality of Production Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluations One Year After Termination of the Project.

The results of the evaluation scores for the two groups are found in Table 23. For comparison, the means of the two groups were adjusted for individual differences in academic ability and intelligence. The Promethean Scholars had a mean score .79 points higher than the mean score for Promethean Alternates. The obtained F ratio (2.181) did not indicate any significant difference in Quantity and Quality of Production between the groups based upon the scores from the teacher evaluation form. Consequently, the null hypothesis was accepted.
Table 23. Relationship of Quantity and Quality of Production of Promethean Scholars to that of Promethean Alternates as measured by the Teacher Evaluation Form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Production Mean</th>
<th>S.D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>F</th>
<th>ndf</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>11.52</td>
<td>2.91</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>10.73</td>
<td>2.66</td>
<td>308.07</td>
<td>59.69</td>
<td>2,431</td>
<td>2.181</td>
<td>N.S.</td>
<td></td>
</tr>
</tbody>
</table>

5i. There Is No Difference in Response to Challenge Between Able Students Who Have Participated in Project Prometheus and Able Students Who Have Not Participated Based Upon Teacher Evaluations One Year After Termination of the Project.

The results of the evaluation scores for Promethean Scholars and Promethean Alternates are found in Table 24. The means for the two groups were compared. Promethean Scholars had a mean score .78 points higher than the mean score for Promethean Alternates. When the means were adjusted for individual differences in academic ability and intelligence, the obtained F ratio (.8745) did not indicate any significant difference between the groups based upon the scores from the teacher evaluation form. Hence, the null hypothesis was accepted.
Table 24. Relationship of Response to Challenge of Promethean Scholars to that of Promethean Alternates as measured by the teacher evaluation form.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Response to Challenge Mean</th>
<th>S. D.</th>
<th>SCAT Mean</th>
<th>CFIT Mean</th>
<th>ndf</th>
<th>F Ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethean Scholars</td>
<td>185</td>
<td>11.39</td>
<td>2.84</td>
<td>312.46</td>
<td>60.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promethean Alternates</td>
<td>250</td>
<td>10.61</td>
<td>2.45</td>
<td>308.07</td>
<td>59.69</td>
<td>2,431</td>
<td>8745</td>
<td>N. S.</td>
</tr>
</tbody>
</table>

Summary

This chapter has presented the analysis of test results utilizing single classification analyses of covariance for group criterion test means. SCAT group means and CFIT group means were applied as covariance controls to group means on the Watson-Glaser Critical Thinking Appraisal, Form YM, the Torrance Tests of Creative Thinking, the Dogmatism Scale, Form E, the Test of Behavioral Rigidity, and the nine factors included in the teacher evaluation form. F ratios were computed and used to determine whether differences in group means on the criterion measures were significant.

Differences in Torrance Tests of Creative Thinking group means between Promethean Scholars and Promethean Alternates were not statistically significant. Differences between group means on the Watson-Glaser Critical Thinking Appraisal, the Dogmatism Scale, and the Test of Behavioral Rigidity were found to be statistically
significant at the .01 level. In all three instances the differences favored the Promethean Scholars.

Application of the same statistical test to the hypotheses relating to the nine factors of concern on the teacher evaluation form resulted in the acceptance of the null hypotheses of no difference between the groups on the following criteria:

- Understanding of Self
- Leadership
- Social Conscience
- Quantity and Quality of Production
- Response to Challenge

Differences in group means favoring the Promethean Scholars were found to be significant at the .05 level for the teacher evaluation measures of Love of Learning and Tolerance of Ambiguity, and at the .01 level for the factors of Critical Thinking and Creative Thinking.
V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to evaluate the effects of a six week residential summer program of differential education for able and gifted high school juniors and seniors from the seven southwestern Oregon counties. It was designed to determine the extent to which high school students who had participated in an intensive, interwoven matrix of interrelated experiences that made up the structure of Project Prometheus were: (a) proficient in aspects of critical thinking, (b) proficient in aspects of creative thinking, and (c) proficient in the ability to maintain an open mind and adjust to the stress imposed by constant environmental change.

The effect of Project Prometheus upon the development of these abilities was investigated by comparing group mean test scores of Promethean Scholars to those of a similar group of able and gifted students who did not participate in Project Prometheus. In addition, a longitudinal assessment was made to determine the long range effects of the project.

All participants in the study were rising junior and senior students from the forty-eight high schools encompassed by the seven southwestern Oregon counties. One hundred and eight-five Promethean Scholars and 250 Promethean Alternates were involved in all aspects
Students were tested in the spring prior to the beginning of the project to establish covariance controls of academic ability and intelligence. Instruments used were the School and College Ability Test, Form 2A and the Culture Fair Intelligence Tests, Scale 3.

Criterion tests were the Watson-Glaser Critical Thinking Appraisal, Form YM, Torrance Tests of Creative Thinking, Form A, the Test of Behavioral Rigidity, and the Dogmatism Scale, Form E.

The study being a post-test only design, the criterion instruments were administered to both groups simultaneously during the fall immediately following the termination of the 1967 summer session.

The longitudinal assessment was made by means of a teacher evaluation form administered one academic year after the termination of the 1967 project year.

Analysis of the data revealed differences in favor of the Promethean Scholars on all four criterion test variables and eight of the nine evaluation form variables. The difference between group means for the WGCTA amounted to 2.63 points. Conversion to percentile ranks on the basis of 11th grade norms placed the Promethean Scholars in the 88th percentile nationwide and the Promethean Alternates in the 84th percentile. Both SCAT and CFIT scores were significantly correlated to the WGCTA scores at the .01 level for both groups. WGCTA scores were observed to be negatively correlated to the
Dogmatism Scale at the .01 level for Promethean Scholars and at the .05 level for Promethean Alternates. While TBR scores were significantly related to WGCTA scores at the .01 level for Promethean Scholars, there was no significant correlation between the scores of the two tests for Promethean Alternates.

Positive, but non-significant correlations were observed between scores on the WGCTA and the Torrance Tests of Creative Thinking for both groups.

An analysis of mean scores on the TTCT indicated relatively small differences in favor of the Promethean Scholars on six of the seven sub tests and the composite creative thinking scores. Comparison of the means of both groups with means for an eleventh grade norm group indicated the general superiority of both groups in this study over the norm group in all areas measured, with greatest superiority in the aspects of verbal fluency and figural elaboration. Correlations between TTCT scores and scores on all criterion and covariance tests were found to be nonsignificant for both Promethean Scholars and Promethean Alternates.

Analysis of the difference in group TBR means revealed that the Promethean Scholars scored 3.67 points higher, in a flexible direction than the Promethean Alternates. Both groups were well within the boundaries of average flexibility for the normative sample.

Scores on the TBR were significantly correlated at the .01 level
to SCAT scores for both groups and to CFIT scores for the Promethean Scholars. While negative correlations were noted between TBR scores and scores on the Dogmatism Scale, for both groups, the only significant negative correlation was noted between scores for Promethean Scholars. For both groups, correlations between TTCT scores and scores on the TBR were nonsignificant.

Mean scores on the Dogmatism Scale indicated that both groups were relatively open-minded. Promethean Scholars scored 3.18 points lower than the Promethean Alternates. A low score indicates a less dogmatic or more open-minded condition.

Correlations between DS scores and scores of the other test variables were all negative with the exception of a non-significant positive correlation with TTCT scores for Promethean Scholars. For Promethean Scholars, correlations significant at the .01 level were noted between scores on the DS and scores on the WGCTA and SCAT. A correlation significant at the .05 level for Promethean Scholars was noted between DS scores and scores on the TBR. The only correlation significant at the .05 level within the Promethean Alternates was noted between scores on the DS and the Test of Behavioral Rigidity.

Analysis of the data computed from the teacher evaluation forms indicated that differences between mean scores ranged from .14 to 1.15 points. The Promethean Scholars scored higher on eight of the nine factors included in that measure.
Correlations between mean scores on the WGCTA and mean scores on the factor of Critical Thinking as measured by the teacher evaluation form were significant at the .01 level for Promethean Scholars but non-significant for Promethean Alternates. Negative, but non-significant correlations were noted between mean scores on the DS and mean scores of the factor of Tolerance of Ambiguity for both groups. A positive correlation, significant at the .05 level, was noted between the mean scores of the TBR and the factor of Tolerance of Ambiguity for the Promethean Scholars. A non-significant correlation was indicated for the same two measures for the Promethean Alternates. Finally, all correlations between mean scores on the TTCT and mean scores on the teacher evaluation form factor of Creative Thinking were found to be non-significant for both groups in this investigation.

Null hypotheses were tested by applying a single classification analysis of covariance using criterion test and evaluation form group means as the unit of analysis. SCAT group means and CFIT group means were applied as covariance controls to the criterion means. F ratios were computed and evaluated to determine whether differences in the criterion measures were statistically significant. Significance was based on the .01 and .05 levels of confidence.

Statistics from these tests resulted in the acceptance of the null hypothesis that there is no difference in creative thinking abilities
between able high school students who participated in Project Prometheus and able students who did not participate as measured by the Torrance Tests of Creative Thinking, Form A.

Similar hypotheses concerning differences in critical thinking abilities as measured by the WGCTA, dogmatism as measured by the DS, and behavioral rigidity as measured by the TBR were all rejected at the .01 level of confidence. All differences were in favor of the Promethean Scholars.

In order to determine the long range effects of the project, the same statistical test was used to test hypotheses relative to the nine factors measured by the teacher evaluation form one year after the termination of the project.

The null hypotheses that there is no difference in Understanding of Self, Social Conscience, Leadership, Quantity and Quality of Production, and Response to Challenge between Promethean Scholars and Promethean Alternates were accepted. Similar hypotheses concerning the factors of Love of Learning, and Tolerance of Ambiguity were rejected at the .05 level of confidence, and those concerning Critical Thinking and Creative Thinking were rejected at the .01 level.
Conclusions

The following conclusions were drawn from the data presented in this study:

1. Critical thinking abilities of Promethean Scholars as measured by the *Watson-Glaser Critical Thinking Appraisal*, Form YM were significantly greater (at the .01 level) than those of Promethean Alternates.

2. Promethean Scholars did not differ significantly from Promethean Alternates in creative thinking abilities as measured by the *Torrance Tests of Creative Thinking*.

3. Promethean Scholars were significantly less dogmatic, as measured by the *Dogmatism Scale*, Form E, than Promethean Alternates (at the .01 level).

4. Promethean Scholars exhibited significantly less behavioral rigidity as measured by the *Test of Behavioral Rigidity*, than Promethean Alternates (at the .01 level).

5. One academic year after the termination of the project, Promethean Scholars exhibited significantly greater critical thinking ability, creative thinking abilities, love of learning, and tolerance of ambiguity as measured by the teacher evaluation form, than did the Promethean Alternates.

6. Promethean Scholars did not differ significantly from
Promethean Alternates in understanding of social conscience, leadership, quantity and quality of production, or response to challenge, as measured by the teacher evaluation form one year after the termination of the project.

7. It is possible to make significant changes in complex performance criteria in an intensive, interdisciplinary program of differential education for able high school students during a six week residential summer session.

8. The cultural, educational and human resources of a rural area such as southwestern Oregon, if pooled, are adequate to provide a program that can attain complex educational objectives.

9. It is possible to get adequate cooperation between school districts to provide regional differential education for able and gifted students provided funds are available on a regional basis.

10. The image of "the creative pupil" held by the teachers in the seven southwestern Oregon counties, who evaluated the participants in this study differs considerably from the concept embodied in the Torrance Tests of Creative Thinking. Evidence for this conclusion was:

   a. Scores on the factor of creative thinking included in the teacher evaluation form were not significantly
correlated to the scores of any of the seven subtests or the three composite factors of the TTCT.

b. Failure to find a significant difference in creative thinking abilities between the two groups as measured by the TTCT while noting a difference significant at the .01 level, between the two groups as measured by the creative thinking factor on the teacher evaluation form.

Recommendations

On the basis of this investigation, the following recommendations are presented:

1. Replication studies should be conducted to determine:
   a. if the global approach of Project Prometheus is effective in attaining complex objectives and providing truly differential education for students selected from:
      1. different socio-economic backgrounds.
      2. different age groups or grades.
      3. urban as well as rural areas.
      4. different levels of academic proficiency.
   b. if the concept embodied in Project Prometheus is effective in programs of varying duration,
c. if the program can be structured to provide experiences more conducive to the development of creative thinking abilities.

d. what effect the project has on the teaching techniques, instructional tactics and educational philosophy of the teachers involved in the instructional program.

e. the effect of the program on the life style, self concept and other personality variables of the students who participated in the project.

f. if the various aspects of the project can be isolated with regards to their individual impact on the development of the educational objectives of the program.

2. A longitudinal study be initiated to determine if the differences found in this study are still evident after the students enter college and assume adult roles in society.

3. The state and federal agencies should encourage and provide funds for continued research into innovative programs designed to provide differential education for able and gifted students.

4. School districts and regional agencies should:

   a. survey the resources available to them to provide differential education programs.
b. encourage and engage in inter-district cooperation to marshall the combined resources of a region in order to facilitate programs that individual districts are unable to provide.

c. set up and implement screening procedures for the early identification of able and gifted students.

d. be encouraged to institute a K-12 program of differential education geared to provide experiences that are normally unavailable to students in the traditional curriculum.

e. increase the quality and quantity of summer programs to provide differential educational experiences for all students who can benefit from them.

5. Teachers and administrators in individual schools should:

a. increase the number of inter-disciplinary courses offered.

b. provide for flexible scheduling to allow for the institution of shorter more intensive courses.

c. be encouraged to survey and use the resources of their communities to enrich their regular curricular offerings.

d. increase the ideational content of the courses designed for able and gifted students.
e. provide their able and gifted students with greater elective choice of courses.

f. provide for more primary experiences in the area of the social, cultural and political forces that are altering contemporary society.

6. Institutions of higher education whose responsibility it is to provide teachers for able and gifted students should:

a. institute courses in their teacher education program:

1. that deal with the identification and special needs of able and gifted students.

2. that emphasize interrelationships of the various subject matter disciplines.


BIBLIOGRAPHY


APPENDIX
DESCRIPTION OF PROJECT PROMETHEUS

History

Project Prometheus was a direct outgrowth of a program initiated in 1961 by the Jackson County Able and Gifted Committee. This early attempt to provide differential education for able and gifted students in Jackson County involved approximately 250 students annually. Special classes taught by faculty members at Southern Oregon College were offered on eight successive Saturdays during the school year. These classes, usually numbering around twenty-five yearly were funded jointly by the Jackson County Intermediate Education District and the Able and Gifted Program of the State Board of Education.

This supplementary academic program, the only such program in the state of Oregon, has continued to operate each year since its inception under the administration of the Jackson County Intermediate Education District.

After operating the Saturday class program for two years, serious consideration was given to the expansion of the program to include four regional residential summer programs for able students throughout the state of Oregon.

In 1964 a request was submitted to the Oregon State Legislature
through the budget of the Oregon State Board of Education to establish the four regional programs. This portion of the budget did not receive legislative approval and the idea of state supported programs was temporarily dropped.

With the passage of the Elementary and Secondary Education Act of 1965 (P. L. 89-10), a new avenue of funding was opened. Application was made to the U. S. Office of Education under Title III, P. L. 89-10 to create and operate a six week residential summer high school for approximately 200 able and gifted high school students from the seven southwestern Oregon counties. Early in 1966, a three year operational grant was contracted to operate Project Prometheus during the project years 1966, 1967 and 1968.

**Area Served**

Geographically, the seven county region served by Project Prometheus lies in a largely mountainous area heavily dissected with numerous shoestring valleys. In terms of distance the counties extend eastward from the Pacific Ocean approximately 240 miles and northward about 140 miles from the California border. The counties - Coos, Curry, Douglas, Jackson, Josephine, Klamath and Lake embrace an area of 26,980 square miles, a region roughly comparable to the combined areas of the states of Maryland, Massachusetts, Delaware, Rhode Island and New Jersey,
Located within this large geographical area is a total population estimated at 312,819 (State Board of Census, July 1, 1964). This represents a population approximately the size of Portland, Oregon, but due to the vast area involved the population density is only a little over 11 to the square mile.

Not only does sheer distance separate the few centers of population density but the diverse landforms limit both transportation and communication, especially east-west travel during the late fall, winter, and early spring months. Besides receiving heavy winter rains and snow, this heavily forested region is cut by two of the nation's four major mountain ranges - the Cascade, and the Pacific Coast range. Traversing the area north and south, these ranges divide the area into three geographic provinces, each having a different climate: the narrow coastal shelf, the intermountain river valleys, and the desert east. The wet coastal region is bisected by at least ten short coastal rivers and innumerable shorter streams. The river valleys which lie between the Coast and Cascade ranges are separated from each other by an east-west mountain spur ranging around 4500' in elevation. The Northern Umpqua River Valley is separated from Oregon's populous Willamette Valley by yet another east-west spur, while the Rogue Valley is cut off from California's great Central Valley by the Siskiyou Mountains, Marble Mountains, and the Trinity Alps ranging from six to eight thousand
feet above sea level. The desert east extends over 110 miles into the volcanic upper Great Basin fault block mountain complex, after being isolated from the river valleys by the volcanic peaks which form the Cascade Range.

All of the major national highways in the region run north-south thereby increasing the isolation of the three geographic provinces embraced by Project Prometheus. Geographically, the regional mid-point would fall within the boundaries of Crater Lake National Park, but the most populous area is embraced by those portions of Jackson and Josephine Counties which lie within the Rogue River Valley. That valley lies about 250 miles south of Portland, Oregon, the nearest metropolitan center, and about 410 miles north of San Francisco, California. The nearest city of the same comparable size to the east is Denver, Colorado, 1,300 miles away.

The project was centered in Ashland, Oregon due to its relatively central location both geographically and demographically and because Ashland is the home of the only four year college in the seven county area.

**Participating Organizations**

The project united five intermediate education districts, five private schools, two county unit school districts, two city high school districts, forty-three public high schools, two regional
chapters of the Oregon Council for Curriculum and Instruction, Southern Oregon College and the Oregon State Department of Education. Sixteen regional cultural organizations were involved, as were twenty-one public agencies and organizations and a great many interested individuals.

A complete listing of the participating organizations includes:

1. **Schools:**

   **Coos County**
   - Bandon High School
   - Coquille High School
   - Marshfield High School
   - Myrtle Point High School
   - North Bend High School
   - Powers High School

   **Curry County**
   - Brookings High School
   - Gold Beach High School
   - Pacific High School

   **Douglas County**
   - Camas Valley High School
   - Canyonville Bible Academy
   - Days Creek High School
   - Douglas High School
   - Drain High School
   - Elkton High School
   - Glendale High School
   - Glide High School
   - Milo Academy
   - Oakland High School
   - Reedsport High School
   - Riddle High School
   - Roseburg High School
   - Sutherlin High School
   - Yoncalla High School

   **Jackson County**
   - Ashland High School
   - Butte Falls High School
Crater High School
Eagle Point High School
Medford Mid High School
Medford Senior High School
Phoenix High School
Prospect High School
St. Mary's High School
Rogue River Academy
Rogue River High School

Josephine County
Grants Pass High School
Illinois Valley High School

Klamath County
Bly High School
Bonanza High School
Chiloquin High School
Gilchrist High School
Henley High School
Malin High School
Merrill High School
Klamath Falls Union High School
Sacred Heart Academy

Lake County
Lakeview High School
Paisley High School

2. Educational Agencies

Aero-Space Workshop, Southern Oregon College
Art Department, Southern Oregon College
Art Workshop, Southern Oregon College
Audio Visual Center, Southern Oregon College
Britt Gallery, Southern Oregon College
Division of Continuing Education State System of Higher Education
Institute of Renaissance Studies, Ashland, Oregon
Instructional Material Center, Jackson County
Junior Band Camp, Siskiyou Band Camp
Living Services, Southern Oregon College
Music Department, Southern Oregon College
Oregon Council of Curriculum and Instruction, Region 5, 6, and 10
Senior Band Camp, Siskiyou Band Camp
Social Science Department, Southern Oregon College
Solar Light Center, Central Point
Southern Oregon College
State Department of Education
Coos County Intermediate Education District
Curry County Intermediate Education District
Douglas County Intermediate Education District
Jackson County Intermediate Education District
Lake County Intermediate Education District

3. Cultural Agencies

American Association of Architects, Southern Oregon Chapter
Ashland City Band
Ashland City Park Department
Jackson County Library
Jacksonville Museum
Oregon Shakespearean Festival Association
Opera Workshop, Southern Oregon College
Peter Britt Gardens Music and Arts Festival
Rogue Basin Singers
Rogue Valley Art Association
San Francisco Ballet Celeste
Scottish Bagpipe and Marching Band
Southern Oregon Historical Society
Southern Oregon Museum of Natural History
Southern Oregon Society of Artists
Sweet Adelines

4. Political Subdivisions and Organizations

Metropolitan Steering Committee, Portland, Oregon
Planning Commission City of Ashland
Planning Commission City of Medford
State Board of Health, Regional Office
Water Department, City of Ashland
Young Americans for Freedom, Oregon
Objectives of the Program

Project Prometheus attempted to marshal the educational and cultural resources of the seven southwestern Oregon counties to create a residential summer school to demonstrate one way to intensify educational programs and provide differential cultural and intellectual experiences for able students. In addition, the project also attempted to demonstrate how local cultural and educational resources can be mobilized to increase primary experiences thereby implementing qualitative educational growth.

The original project proposal delimited four major objectives and sought:

1. To provide unique cultural and intellectual experiences normally unavailable for such students during the regular school year.

2. To demonstrate how regional cultural and educational resources can be mobilized to implement qualitative educational improvement of high school academic programs.

3. To develop and to operate innovative, inter-disciplinary classes of timely significance.

4. To increase, intensify, and broaden the able student's intellectual curiosity and cultural inquiry.

After the first year the faculty and staff identified four additional objectives which involved the student participants directly.
These four objectives basically involved a refinement of the fourth objective just cited, and attempted:

1. To intensify the student's awareness of the tentative nature of his conclusions.

2. To increase the student's ability to process information critically.

3. To extend the student's involvement in cultural and intellectual activities.

4. To attempt to create an educational environment that was conducive to creative thinking on the part of the students and faculty.

**Environmental Structure**

The structure of the Promethean environment was basic to the whole project operation. Basically, the theory is that complex educational objectives are best achieved when the entire educational program is geared to providing experiences for students that create an environmental climate conducive to the development of those objectives. Furthermore, the entire six weeks was intended to be a single comprehensive experience to capitalize on Maslow's hypothesis (65) that a single powerful experience may have much more impact on individuals than a great many unrelated and less powerful experiences stretched over a lengthy period of time.
To provide this "peak" experience, the matrix of concepts and experiences that made up Project Prometheus were interwoven into a six-strand construct, designed to introduce the students to the ideas and concepts that the staff felt were necessary to understand the forces of change wracking the contemporary world.

The Promethean matrix of experience and concept was designed to use the Mini-Course to increase the total quantity of contemporary ideas a student has; the Perspective Series was used to inter-relate experiences as well as to demonstrate pluralism and to extend the diversity of the program; the Cultural Conflict Seminars were designed to promote involvement in and commitment to better understanding of the major issues in American society; the Major Classes provided a study in depth of two interdisciplinary areas of learning; the Horizon Program attempted to broaden the cultural horizons of the students and provide meaningful experiences related to underlying themes of the entire Promethean program; the Field Trips were designed to increase the quality of instruction by providing primary experiences and concrete examples of classroom abstractions.

**Instructional Pattern**

The daily schedule was flexible enough to take advantage of community and student-faculty initiated activities although its general nature was normally as follows:
7:00 - 7:45 Breakfast in the dining hall at the living complex

8:00 - 9:15 Mini-Course in lounges in the living complex

9:15 - 9:29 Break time, used to cross campus

9:30 - 10:25 Perspective program (lecture-demonstration series held in one of the college auditoriums, flexible time span)

10:30 - 11:59 Cultural Conflict Seminars in lounge areas in living complex

12:00 - 1:00 Lunch in living complex

1:00 - 3:00 Major Classes held in classrooms in Science Hall, or the Social Science Building

3:00 - 5:00 Recreational activity - some student scheduled activities, but generally open for individual interests.

5:00 - 5:45 Dinner in living complex

5:45 - 6:30 Open

6:30 - 7:30 Reading time

8:00 Horizon Program (cultural series, flexible)

11:00 Dormitory doors locked

12:00 Bedtime

Some activities were planned for weekends, such as field trips, mountain climbing instruction and picnics, but Sundays were open for individual activities including church attendance. The middle weekend which divided the program into two, three-week terms was set aside for home visits and all of the students left the campus for a two day vacation.
The Mini-Course

The mini-courses, an addition to the 1967 program as a consequence of suggestions from 1966 Promethean Scholars, was a one-week long course designed to introduce the students to contemporary ideas in various fields of intellectual endeavor. Often a distillation of one of the depth courses taught in the afternoon, the mini-course offered six hours of instruction, and provided each Promethean Scholar with the opportunity for exposure to six areas of knowledge in addition to his two Major Classes. As the teachers attempted consciously to structure these courses around contemporary ideas and concerns, the net effect was to increase the number of contemporary ideas to which the individual student was introduced. The cognitive input was ideational, and helped to establish the configurational network of theory and concept upon which previously acquired factual data as well as subsequently acquired data, could be arranged. In this way the normal linear pattern of instruction was ignored, making possible greater use of the teachable moment.

The courses taught during 1967 were the following:

1. AID and Human Dignity (Gene Rosaschi)
2. The Southerner (Robert Kimzey)
3. Seminars in Contemporary Dilemmas (Robert Mathews)
4. The Problem of the City (Robert Farrelly)
5. The Problem of Cultural Discontinuity (Charles Nevi)
6. The Genetic Future of Man (Chester Bowser)
7. Experiments in Creativity (Kay Keyes)
8. An Exploration of Self (John Smock)
9. The People, the "Pop," and the Pap (James Tacchini)
10. A Biological View of Man (Ronald Lamb)
11. Group Behavior (Robert Bayley)
12. Approaches to Creativity (Robert DeVoe)
13. The Individual's Voice (Kenneth Ballweg)
14. The Absolute in Modern Life (Thelda Bevens)

The Perspective Program

The Perspective Program was a lecture-demonstration series of some thirty programs designed to provide diversity of viewpoint, as well as to focus the attention of the scholars on various other sections of the program. By keying on a subject area taught in one of the classes, by using preview techniques of one of the evening cultural programs or by presenting programs which would tend to motivate discussion in the seminars, the Perspective Program unified and provided a conceptual intertwining of the other phases of the program. The various Perspective Programs which normally utilize the human resources available in the immediate area or persons who were visiting the region, are listed below in order of appearance:
July 10  Opening ceremonies, Dr. Elmo Stevenson, President, Southern Oregon College, and the Project Staff.


July 12  "Some Characteristics of Poverty," Keven Collins, Dean of Students, University of Portland, recently Director of Upward Bound program at University of Oregon, Portland.

July 13  "The Young Conservatives View," James Casterline, State Chairman, Young Americans for Freedom, Medford.

July 14  "Oregon's Constitution and the Treatment of Minority Groups," Dr. Donald Balmer, Lewis and Clark College, Portland.


July 18  "A Preview of Pericles," James Tacchini, Prometheus staff.


July 20  "Taming of the Shrew in Profile," Robert DeVoe, Prometheus staff.

July 21  "Elements of Folklore," J. Barre Toelken, Assistant Professor of Medieval Literature and Folklore, University of Oregon, editor Northwest Folklore.

July 25  "Survey of Ames Research Center Rocketry Programs," Harold R. Bacon, Ames Research Center, California, presented in conjunction with Aerospace Workshop.

July 26  "Who Dares, Wins?," Mt. McKinley Climb, Thomas Nash, Superintendent, Jackson County Intermediate Education District, Medford.

July 27  "How to Listen to Music," Dr. Herbert Cecil, Southern Oregon College Music Department.

July 28  "Automation: Friend or Foe," Tom Jones, Assistant Professor of Business, Southern Oregon College, Ashland.

July 31  "Antony and Cleopatra: The Director's View," Dr. Jerry Turner, Director, Oregon Shakespearean Festival, Ashland.

August 1  "The Common Man and Ortega y Gasset," Dr. Arthur Kreisman, Dean of Liberal Arts and Sciences, Southern Oregon College, Ashland.

August 2  "Political Extremism," William Meulmans, Assistant Professor of Political Science, Southern Oregon College, Ashland.


August 4  "The Pollution Problem," Leo Baton, State Board of Health, regional office, Medford.

August 7  "The Peace Corps," Gene Rosaschi, Prometheus staff.

August 8  "Latin America: Revolutions of Rising Expectations," Dr. Jose Ferrer, Assistant Professor of History, Southern Oregon College, Ashland.

August 9  "China: Reality and Illusion," Dr. Mary Harbert, Associate Professor of History, Southern Oregon College, Ashland.
One of the secondary aims of the Perspective Program involved the presentation of different kinds of professionals to the Promethean Scholars. Most people number a limited number of professionals in their circle of acquaintance. This program attempted to introduce the students to various kinds of individuals who could serve as models for students seeking occupational horizons not commonly familiar. In general, the Perspective Series attempted to provide an introduction to the pluralism of value and belief that exists in society.

Cultural Conflict Seminars

In an attempt to introduce the Promethean Scholars to social issues of general concern, issues arising from situations with which society must continue to cope, a separate, weekly topic was chosen to serve as a focal point of discussion. At least one major speaker
of national prominence addressed the scholars during each week. These same topics were used successfully during 1966, and were recommended by the subjective reports of the 1966 Promethean Scholars for inclusion in the 1967 program. The topics in order of weekly attention and the speakers were as follows:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnocentrism</td>
<td>Charles Weltner, Deputy Chairman Democratic National Committee, former Congressman from Atlanta, Georgia.</td>
</tr>
<tr>
<td>Urbanization and Alienation</td>
<td>Dr. H. Wentworth Eldredge, Chairman, Department of Sociology, Dartmouth College, New Hampshire.</td>
</tr>
<tr>
<td>Technology and Human Values</td>
<td>Mark O. Hatfield, Senator from Oregon, former Governor of Oregon.</td>
</tr>
<tr>
<td></td>
<td>Dr. Wayne Morse, Senator from Oregon, former Dean of the School of Law, University of Oregon.</td>
</tr>
<tr>
<td>Liberty and Social Cooperation</td>
<td>Edith Green, Congresswoman, Third Congressional District, Oregon.</td>
</tr>
<tr>
<td>Emergence and Aspiration</td>
<td>Adolf Berle, director, 20th Century Fund; former Ambassador to Brazil; former Assistant Secretary of State to Latin America.</td>
</tr>
<tr>
<td>Leadership in a Multi-Cultural World</td>
<td>John Dellenback, Congressman, Fourth Congressional District, Oregon.</td>
</tr>
</tbody>
</table>

This phase of the Prometheus program, dealing as it did with crucial social conditions, automatically placed the student in a vortex of social forces which, it was hoped, would compel
commitment. Confronted with unsolved issues which are laden with value choices, placed in a comfortable lounge atmosphere conducive to open discussion, beset by the curious eyes and ears of his peers, led by a trained discussion leader, the Promethean Scholar felt constrained to take a position on the topic before the group. The seminar discussion, from an educational viewpoint provided the opportunity for basic encounter: the scholar encountered his own belief and value system, often for the first time consciously, had the opportunity to test those beliefs against those of his contemporaries, and commit and involve himself with his choices and the logical consequences which evolve from them. In short, he had the opportunity, in a nonthreatening environment to test himself against the ideological world of his peers.

**Major Classes**

During each of the three years that the project was in operation, twenty-eight classes of three weeks duration were created and taught by teachers who were chosen specifically because they were creative, communicative, broadly educated, and had diverse professional backgrounds.

The classes were designed to break the cultural lag between what is known and what is taught. They sought to be timely, significant, and packed with ideational content. In an attempt to provide
truly differential education a conscious effort was made to design courses that are not normally taught during high school or during the first two years of a typical undergraduate college program.

Within the limits of professional conscience, the teachers decided what they wanted to teach, structured the course, chose the texts and other reading materials, and had free rein regarding classroom tactics, discipline, instructional media and group activities both inside and outside the classroom, during the allotted time for their class. The freedom to teach innovatively was enhanced by the absence of any grading system or administrative paperwork.

Students were assigned to two classes according to preference and postmark date of action, selecting six possible courses to allow some flexibility on the part of the project staff. There were no graded tests and no final evaluation of students. The students engaged in educated games, simulations, did library work, gave reports and engaged in a great deal of class discussion. An intensive use of field work and of model building as well as more traditional audio-visual devices was observed. The 1967 classes were:

The Art and Challenge of Feature Writing (Keyes)

A laboratory class dealing with that type of creative writing which produces feature stories and magazine articles. Individual attention given to individual interest.
The World of Fantasy (Keyes)

The world of fantasy was explored through an analysis of J. R. R. Tolkien's *The Hobbit*, and his trilogy *Lord of the Rings*. The class affiliated itself with the Tolkien society, a national organization, and published a newsletter, *The Angerthas*. They also worked on a reading theater production of episodes from the books. The significance of fantasy in contemporary society was analyzed.

The Problems of Popular Culture (Tacchini)

An investigation into the reasons for popular acclaim of best-selling literary works, popular TV programs, and other phenomena relating to mass literature and mass consumption of ideas.

The Dramatist and Social Consciousness (Tacchini)

An individual survey of various plays of Shaw and Pirandello, dramatists concerned with trends in early 20th Century society. By concentrating on this particular period significant understandings of contemporary life were achieved.

Theories of Human Interaction (Bayley)

An Analysis of various theories behind group behavior and individual responses to social situations was employed. Some consideration was given to the function of social conflict as well as to basic encounter situations in small group sessions.

Problems of Communication (DeVoe)

A course dealing with the various communication media and communication theory, especially the recent insights of Marshall McLuhan. Some attention was given to the general semanticists and contemporary psychological theories.

Polaristic Approaches to Reality (DeVoe)

A philosophic investigation of the various theories regarding reality, goodness, and human action. Discussions, drawing upon individual experiences and wide-reading of philosophers and literary figures, occurred. Many texts were employed and extensive library research was used.
The Individual Versus the Theatre (Ballweg)

A critical examination of the position of theatre arts within our culture and of the position of the artist within the art. Extensive use was made of tours to the Shakespearean Festival Theatre (a replica of the Fortune Theatre), of professional actors, costumers, lighting technicians, directors, etc. The creation of a controlled environment called Mac-E was a major project.

The Playwright, The Play, and The Audience (Ballweg)

A consideration of the uniqueness of dramatic experience stemming from a unity created by the interaction of the play, the production and the audience. Particularly designed for Prometheans who were interested in theatre arts, the course used the five Shakespearean Festival performances as reference points and employed the same sort of field work as the previously cited theatre class.

The Role of Science Fiction (Bevens)

An investigation into contemporary science fiction as an expression of our times; its significance and its function. Attention was given to what makes readers respond the way they do to science fiction. Bradbury's Fahrenheit 451 and Heinlein's Stranger in a Strange Land were the principal texts, although extensive individual reading occurred.

Sources of Humor (Bevens)

Everybody laughs but few people know why. Comedians exploit this ignorance; speakers manipulate it; TV programs sell it. This course attempted to teach the students to understand humor. The psychological bases of humor were investigated. Original research in college desktop graffiti was one of the class projects.

Symbols and Civilization (Nevi)

An investigation into the role that symbol systems have played in human societies. A look at the role of relationships between various civilizations and underlying symbol systems was employed. Golding's The Inheritors and Fromm's The Forgotten Language were used as texts.
Comparative Embryology (Bowser)

A laboratory study of amphibians and bird embryology in various stages of development comprised the course. Experiments with the eggs produced genetic alteration. The relationship between embryology and genetics was explored.

Man and Mutation (Bowser)

All living things mutate. This course surveyed what is known about human mutation and the effect it has on man and human society. The causes of mutation were studied as well as the genetic changes that are known to have occurred and to be occurring.

Animal Communication Patterns (Lamb)

The course dealt with the means by which animals communicate and treated both concrete and abstract information on how these systems evolved. The complex social behavior, warning signals, and recognition were covered. The course tended to be an introduction to contemporary knowledge of psychobiology.

Man and Desert (Lamb and Bayley)

A study of the relationships between man and the deserts he lives in or creates. Team-taught by a natural historian and a social scientist, the class toured Oregon's high desert investigating the unique geological, anthropological, biological and social relationships developed by desert dwellers.

The American in 1984 (Kimzey)

A projection of present trends into the future so as to provide the student with the various theoretical models which may help humans cope with what may likely happen in the next twenty years.

Totalitarianism and the Authoritarian Personality (Kimzey)

Totalitarianism has been the motive power for the rise of modern dictatorships and this course analyzed these movements, placing them into cultural and psychological perspective.
**Africa-Land, Culture and Challenge** (Rosaschi)

A course dealing with the peoples and cultures of Africa as seen from the perspective of the cultural geographer. The focus of class activity centered on the changes this continent has experienced and on those changes presently occurring or foreseen.

**The Ethiopian - A Study of Cultural Perspective** (Rosaschi)

A depth study of Ethiopian culture both ancient and modern. Ethiopia has been free since the time of Solomon and for centuries was the only native African state. The course studied the uniqueness that has made her so and kept her so.

**The Dilemma of Empire** (Matthews)

A course that dealt with the problem of world-wide economic development and the traditional ideas of territoriality and sovereignty. The various theories concerning what causes some peoples to be the "haves" and some to be the "have nots" were presented. Possible future difficulties and future chances for more affluent development were investigated.

**The Psychology of Mass Movements** (Matthews)

Many people commit themselves to massive social movements without knowing the reasons for that commitment. In a world of increasing population and urbanization, mass movements are to be expected; this course probed history for examples of this phenomena (using Hoffer's *The True Believer* as a basic text), and attempted to analyze these case histories as well as to apply the knowledge gained to contemporary movements.

**Innovation in Urban Societies** (Farrelly)

This class dealt with the growth population, the urban problems of physical and human development, and the whole concept of urban planning. Field trips to neighboring city planning commissions and to key sites (watershed, filtering plants, etc.) occurred. Two major class projects developed: nine blocks in downtown Ashland were studied, planned and mapped to indicate suggested alterations; and an ideal city model was constructed to give students experience in actual planning problems.
Asia - Background for Ideology (Farrelly)

The relationships developing among the Asian countries, both internally and externally, as they array themselves politically and militarily along paths which may well decide the future of Asian democracies were studied. A diplomatic and military game involving situations and responses which created new situations was employed to highlight and personalize the social forces at work in this area.

Patterns of Change (Smock)

The course analyzed the historical ways change has occurred in human society; political, intellectual, social and economic. The role of research and development was scanned as were more violent revolutionary change patterns. Crane Brinton's classic work the Anatomy of Revolution served as the initial text.

Conformity in Modern Life (Smock)

The course conducted an investigation of the increasing facelessness that is experienced by modern man and his seeming powerlessness to act individually in some significant way. The students studied the forces that created this alienation and discussed the remedies normally suggested.

Patterns of Cultural Discontinuity (Nevi)

Using Peter Drucker's significant book Landmarks of Tomorrow as a primary text, the class investigated the post-Cartesian world and the configurations of modern life. The demographic projections were surveyed and the challenges these bring to social institutions in regard to cultural continuity were investigated.

Course syllabi have been prepared by the faculty, and will be edited and ultimately made available to the individual teachers in the forty-eight member schools from Southwestern Oregon.

Close analysis of the courses created by Promethean faculty members shows some over-riding concerns, and general themes which
ran throughout the program. Some of the major interlocking themes are as follows:

- Human symbol systems
- Creativity patterns
- Value and belief systems
- Mass media impact
- Geographic planning and development
- Psychobiology
- Genetics
- Economic development
- Power structures
- Change phenomena
- Social consciousness and involvement
- Totalitarian tendencies
- Group interaction
- Tribalism
- Relativity
- Area Studies: Africa, Asia, Central and South America, The Pacific
- Futurism
- Mass movements
- Innovation

**Horizon Program**

The Horizon Program was designed to mobilize the cultural offerings in the area and to supplement the variety available by presenting programs that are normally unavailable to students living in an isolated rural environment. Whenever possible, programs dealing with a particular concept or idea were scheduled to coincide with the corresponding major themes of the Cultural Conflict Seminars.

The programs for 1967 in order of presentation are listed below:

July 10 - 15 Art show, Alan Monroe, Britt Gallery
July 10  Reception for Promethean Scholars

July 11  Folksinger, Mike Lieber, anthropologist and folklorist

July 12  "1965 Award films of the First National Student Film Festival" as presented at Lincoln Center

July 13  "Dialogue on Architecture," Charles Warren Callister, architect. Presented in cooperation with the Rogue Valley Art Association

July 14  "Creation" and "Alley Art," a multimedia presentation by Donald Hunter, Instructional Media Center, University of Oregon

July 15  Junior Band Camp Recital, Lithia Park (optional)

July 16 - August 4  Art Show, prints, Jack Burgner, Britt Gallery

July 17  "Sad Clown," film, presented by Art Workshop (optional)

"Ballad of a Soldier," Russian film

"Loves of Franistan," short film

"Triumph of Will," German propaganda film

July 18  "Mark Tobey and Neighbors," film (optional)

"Pericles, Prince of Tyre," Oregon Shakespearean Festival Theatre

July 19  "The House," film (optional)

"Asia-Oriental and Russian," travelogue, Robert Farrely, Promethean faculty
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<th>Date</th>
<th>Event</th>
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<tr>
<td>July 20</td>
<td>&quot;Reality of Karl Appel,&quot; film (optional)</td>
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<td>&quot;Taming of the Shrew,&quot; Oregon Shakespearean Festival Theatre</td>
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<td>July 21</td>
<td>Concert, folksongs, J. Barre Toelken, folklorist and singer</td>
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<td>July 24</td>
<td>&quot;The Responsive Eye,&quot; film (optional)</td>
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<td>&quot;The Artist at Bay,&quot; a panel discussion by professional artists</td>
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<td>illustrated with their works. Artists included Nan Nalder, Marilyn</td>
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<td>Briggs, Dorothy DeYoung, Betty LaDuke, and Robert Bosworth</td>
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<td>July 25</td>
<td>&quot;Five British Sculpture&quot; film (optional)</td>
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<td>&quot;Nobody Waved Goodbye,&quot; Canadian film</td>
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<td>July 26</td>
<td>&quot;Marcel Duchamp,&quot; film (optional)</td>
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<td>Scottish Bagpipe and Marching Band Concert, Ashland Elks</td>
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<td>July 27</td>
<td>&quot;Henry Moore,&quot; film (optional)</td>
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<td>Ashland City Band Concert, Lithia Park Band Shell</td>
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<td></td>
<td>&quot;The Stately Homes of England,&quot; Jay Ryan, lecturer, illustrated</td>
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<td>lecture</td>
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<td>July 28</td>
<td>Senior Band Camp Recital, Lithia Park, (optional)</td>
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<td>July 31</td>
<td>&quot;Antony and Cleopatra&quot; Oregon Shakespearean Festival Theatre</td>
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<td>August 1</td>
<td>&quot;To Die in Madrid,&quot; Spanish documentary film</td>
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<td>&quot;Manolete,&quot; Spanish bullfighter film</td>
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August 2    Recital, Pauline Thorstenson, soprano
August 3    Poetry reading, Dr. Arthur Kreisman, Professor of English, Southern Oregon College, poet
August 4    "Little Mary Sunshine," musical comedy
            "The Magic World of Topo Gigo," film
August 6 - 18 Art Show, prints, traveling exhibit Ferdinand Rotand Galleries
August 6    "Giselle" and "Peter and the Wolf," the San Francisco Ballet Celeste
August 7    "History of Jazz," Concert lecture, Charles Ruff, Humanities consultant, Division of Continuing Education
August 8    "Animal Farm" animated film
            "A Short History," Romanian film
            "Mein Kampf," film
August 9    Poetry Reading, Gregory Keith, poet
August 10   "Richard III," Oregon Shakespearean Festival Theatre
August 11   "Jacksonville: A Historical Resource," Dr. Frank Haines, historian
August 12   "Royal Fireworks," Handel-Harty
            "Piano Concerto in A" Schumann
            "Symphony #8, Evening," Haydn
            "Suite Symphonique," Ibert
            Peter Britt Gardens Music and Arts Festival, Jacksonville
August 14   Rogue Basin Singer and Sweet Adelines, barbershop concert - Society for the Preservation and Encouragement of Barbershop Singing in America, Inc.
August 15  Poetry Reading, William Stafford, Lewis and Clark College, poet

August 16  "Serenade #11," Mozart
"Soldier's Tale" Stravinsky

        Peter Brit Gardens Music and Arts Festival


August 18  Banquet, Congressman John Dellenback, Principal speaker

Field Trips

Regularly scheduled and individually initiated field trips were an integral part of the Prometheus program. Some of these occurred during regularly scheduled class time, some were Saturday trips, and others were for small groups. Many small group trips to see significant films at commercial theaters, or to view the several art galleries, bookstores, antique shops, puppet shows, or to hear many public lectures sponsored by churches, private organizations, Southern Oregon College, or the Institute for Rennaisance Study are not listed. A sampling of the more formal locations visited and of the activities connected with these locations is cited.

Picnic, Lithia Park, including the Museum of Natural History and the Nature Trail
Lava Beds National Monument with side trips to Captain Jack's Stronghold, the site of the last American Indian War

Fort Vannoy Job Corps Center

Rogue Gallery, the Public gallery sponsored by the Rogue Valley Art Association
   Two Shows: Rogue artists (painting, stichery, sandcast, and collage) and the Tom Hardy Sculptures

Medford Planning Commission

Ashland Sewage Plant

Ashland City Hall

Jacksonville Museum

Greenwich Village Art Show

Oregon Caves National Monument

Newberry Crater

Lava Butte State Park

Fort Rock Cave

Christmas Valley

Malheur Game Refuge

Steens Mountain

Jacksonville-National Historical Landmark

Mt. Ashland Ski Resort

Promethean Siskiyou Mountain Climbing School

As with the cultural experiences, this type of primary experience made classroom theory more meaningful and established the world outside of the school room as an integral part of the
instructional program.

**Visiting Speakers**

Many of the classes and seminars employed local speakers, extending the whole idea of Promethean education into the individual classes. Local writers, thinkers, administrators, artists, architects, and advocates of self-chosen causes were welcome to contribute to class sessions upon invitation and coordination by the teachers or students.

**Faculty and Staff**

The faculty and staff of Project Prometheus were selected on the basis of demonstrated competence in the classroom, diversity in background and experience, ability to communicate with students and a sincere interest in providing differential education for able and gifted individuals.

To insure the maximum impact of the program in the region being served, care was given to select teachers from the seven southwestern Oregon counties whenever possible.

The faculty members were free to decide what they wanted to teach, how they wanted to structure the courses, what texts to use and what classroom tactics they wished to employ. The administration and staff made every effort to provide the necessary equipment, audio
visual and other instructional aids that each faculty member needed to teach his courses.

The following is a list of faculty and staff for the 1967 session of Project Prometheus:

Robert Bayley, 207 Kings Way, Central Point, Oregon (political science)

Kenneth Ballweg, 19 Hillcrest Drive, Ashland, Oregon (humanities)

Thelda Bevens (Mrs. Darwin), 1620 Parnell Drive, Eugene, Oregon (humanities)

Chester Bowser, P.O. Box 43, Glide, Oregon (biology)

Marcella Chiavaras (Mrs. Howard), Principal, Canyonville, Oregon, Canyonville Elementary School (counseling)

W. M. Christensen, Principal, Lakeview High School, Lakeview, Oregon (counseling)

Robert DeVoe, 549 Auburn, Ashland, Oregon (humanities)

Robert Farrelly, Northwest Community Action Training Center, Portland Continuation Center, Division of Continuing Education, Portland State College, Portland, Oregon (urban geography)

Mary Gaulke (Mrs. Bud), Canyonville, Oregon (counseling-family life)

Kay L. Keyes (Mrs. James), 915 West Barrett, Seattle, Washington (humanities)

Robert Kimzey, Principal, High School Division, North Carolina School of the Arts, Winston-Salem, North Carolina (economics-political science)

A. G. Korieva, Marshfield High School, Coos Bay, Oregon (counseling)
Promethean Scholars

The procedure that was used to select participants for the program grew out of an analysis of the results of the Jackson County Able and Gifted Saturday Class program that had been in operation for four years prior to the initiation of Project Prometheus. This initial
attempt by educators in Jackson County to provide differential education for able and gifted students had drawn about 500 qualified students per year from the Jackson county schools. This number represented 10.2% of the normal high school population. According to studies reported by Gallagher (35), Henry (44) and Hildreth (47), the top ten percent of the students in high schools, as measured by achievement tests and intelligence tests, would include those individuals classified as highly gifted, gifted, and academically talented. This group represented the target population for Project Prometheus.

Administratively, the program was designed to provide for 200 eligible students in each of the three project years. In 1967 this represented approximately ten percent of the 1,994 students who were theoretically eligible due to being in the top ten percent of the student population in the project area.

As the project was designed to serve the entire seven county region, and as a demographic analysis indicated that the student population was not evenly distributed throughout the area, selection procedures were designed to spread the impact of the program over the seven-county area.

Eligibility for the Program

To be eligible for the program, students had to meet the following criteria:
1. The student must be a member of the sophomore or junior class of any one of the 48 cooperating high schools during the spring semester, 1967.

2. The student must have a minimum I.Q. score of 122 on a nationally standardized intelligence test.

3. The student should score in the 95th percentile or above on a recent nationally standardized achievement test.

Application Procedures

Application forms were sent to each of the participating high schools accompanied by a description of the program, deadline dates for application, and instruction on eligibility. Each school was instructed to screen students on the basis of eligibility requirements and to distribute applications to the eligible students. Responsibility for submitting application by the deadline date was then up to the individual student. Those who chose to apply submitted the application form to their principals who were instructed to send the form and an official transcript of high school work to the project office.

Selection of Scholars

In the spring of 1967, applications were received from 557 eligible students. To select 200 scholars from this group, on an impartial basis, selection teams of professional educators from each county were asked to evaluate applicants from schools located in counties other than their home counties.
Utilizing the information available to them on the transcripts and application forms, in the form of test scores, grades, and recommendations of school authorities, the selection teams chose 100 male scholars and 100 female scholars according to the following formula:

1. Two students from each high school if two were eligible. This provided about 50 percent of the students.

2. One half of the remaining positions were filled with students who were selected because their positions on the selection list placed them as the most able.

3. The remaining participants were selected in accordance with county population figures.

By such a distribution, an equitable demographic balance was achieved and the cultural and educational emphasis of Project Prometheus was extended throughout the geographic region.