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The Effects of a Pretesting Session on the Scores Obtained by Adults on a Nonverbal Test of Intelligence

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THE EFFECTS OF A PRETESTING SESSION ON THE SCORES OBTAINED BY ADULTS ON A NONVERBAL TEST OF INTELLIGENCE

by

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VITA

The author, Carole Ann Bauer, is the daughter of Ralph J. and Catherine (Ponic) Bauer. She was born March 30, 1935, in Chicago, Illinois.

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CHAPTER 1

INTRODUCTION

Statement of the Problem

The general aim of this research is to determine if the intelligence test scores of adults who attend a pretesting session or presession are significantly higher than those who do not. The purpose of the pretesting session or presession is to explain test-taking techniques and to provide additional motivation for the subjects to perform well on the test. The test will be an untimed, nonverbal test of intelligence, specifically, the Raven Progressive Matrices Test. The subjects for this study will be selected from the population of students enrolled at Triton College.

Two factors often listed as contributing to poor test scores obtained by adults are the lack of orientation to testing procedures and the lack of motivation and/or cooperation (Baltes & Schaie, 1974; Bischof, 1969; Chisholm, 1970; Cleugh, 1962; Pressey & Kuhlen, 1957; Wechsler, 1958). Akhurst (1970) lists the attitude of the testee toward the tasks presented as an important variable that is sometimes overlooked. The presession is an audiovisual presentation designed to acquaint the adults with methods of approaching a testing situation. Topics explored in the presession include listening to directions and when to ask questions. The presession will also present an explanation of why directions should be followed and how to mark answer sheets. Additional topics considered in the presentation are which questions to answer first and when to guess. Another purpose for the presession is to provide additional motivation for the subjects to perform well on the test and to elicit the fullest cooperation of the adults. This should be possible if the presession explains the future use of the skills learned in the presession.

A secondary aim of this study is to determine, if possible, whether an intellectual incline, plateau, or decline is associated with increasing age. The change in intelligence test scores with increasing age has been intimated to be a gradual decline by cross-sectional studies, especially on nonverbal or performance tests (Chown, 1972; Miles & Miles, 1932). This has not been supported by longitudinal studies (Bayley, 1955; Bayley & Oden, 1955; Eichorn, 1973) that show an increase in intelligence test scores for some mental functions and/or some groups of individuals. Kimmel (1974) suggests that the change in intelligence test scores with age is somewhere between the drastic decline indicated in cross-sectional data and the continuous gradual increase for highly intelligent subjects found in longitudinal data. The change is probably bounded by the cross-sectional data at the bottom and the longitudinal data for average subjects on the top. The discrepancies between the results of cross-sectional and longitudinal investigations have been frequently discussed (Bromley, 1966; Chown, 1972; Hurlock, 1968; Kimmel, 1974; Koos, 1970; Kreitlow, 1970; Lunneborg, Olch, & deWolf, 1974; Owens, 1966; Wechsler, 1958). In a study by Schaie and Strother (1968), the most important conclusion that was drawn was the finding that a major portion of the variance attributed to age differences in past cross-sectional studies must properly be assigned to differences in ability between successive generations. Findings of this nature could have implications for adult education now and in the future. Schaie (1974) argues for the desirability of "Head Start" types of programs for the elderly.

Another aim of this study is to determine, if possible, if the difference in test scores for males and females is significant. Differences in test scores for males and females are usually not related to overall general intelligence but rather to specific abilities, to a task involved, or a test used (Chisholm, 1970; Stafford, 1972). Related to this aim is the question of whether age trends in intelligence test scores differ for males and females. With respect to mental ability, both Birren (1964) and Geist (1968) state that data regarding differences between males and females in relation to age are almost nonexistent in the United States. Bromley (1966), on the other hand, suggests that age-changes in mental ability are the same for both males and females. A significantly greater verbal ability for females and significantly greater quantitative, spatial, and mechanical reasoning abilities for males were found in a sample of middle aged adults as well as university freshmen (Lunneborg et al., 1974).

A final area of consideration is the effect of the educational level of a person upon his performance on an intelligence test. Intelligence tests tend to favor the individual with more formal schooling (Cohen, C., 1962). Guilford (1967) finds a strong correlation between the amount of formal education and the development of intellectual abilities. In studying the effects of age upon mental ability, it is important to control for the effects of education by statistical or experimental means (Botwinick, 1973). Lugo and Hershey (1974) suggest that the amount of education is a better explanation for the changes in test performance than any previously stated explanation. Failure to control for the educational level or years of formal education may result in an exaggerated decrement in test score for older adults since these persons may tend to have fewer years of formal schooling (Botwinick, 1973). Additionally, Guilford (1967) claims that education as a variable is becoming more hazy as a consequence of the growth of adult and continuing education programs.

Summary of the Problem

An analysis has been presented explaining some of the factors affecting the intelligence test scores obtained by adults. Test taking orientation and motivation have been frequently listed as important factors for older adults. The preceding analysis indicated some of the problems in determining the effect of age upon test performance. There are discrepancies in the results of cross-sectional and longitudinal investigations. The preceding analysis further indicated the female disadvantage in nonverbal tests.

The main purpose of the present study was to examine the effect of a presession on the intelligence test scores obtained by adults. It was hypothesized that attendance at an informational and motivational presession would raise the test scores. It was further hypothesized that a presession would affect older subjects more than younger subjects. Similarly, it was hypothesized that a presession would affect female subjects more than male subjects.

A secondary purpose of this study was to determine if an increase in age would produce a decrement in test score. It was hypothesized that older subjects would score lower than younger subjects. It was further hypothesized that older subjects would demonstrate a greater disparity in test scores between males and females than younger subjects.

Another purpose of this study was to examine the test scores of males vs. females. It was hypothesized that female subjects would score lower than male subjects.

Research Hypotheses

The presession is designed to orient the subjects to test taking techniques and to increase the motivation to perform well. If the presession is effective, subjects will obtain higher scores on an intelligence test than subjects who do not attend a presession.

The following research hypotheses will be tested:

1. Subjects who attend a presession will score higher on the Raven Progressive Matrices Test than those who do not attend a presession.

2. Older subjects will score lower on the Raven Progressive Matrices Test than younger subjects.

3. Female subjects will score lower on the Raven Progressive Matrices Test than male subjects.

4. The difference in test scores on the Raven Progressive Matrices Test between those attending a presession and those not attending will be greater for older subjects than for younger subjects.

5. The difference in test scores on the Raven Progressive Matrices Test between those attending a presession and those not attending will be greater for female subjects than for male subjects.

6. The difference in test scores on the Raven Progressive Matrices Test between male and female subjects will be greater for older subjects than for younger subjects.

CHAPTER II

REVIEW OF RELATED LITERATURE

Intellectual Change with Age

There is evidence that the difference in performance between younger and older subjects on tests of intellectual ability is not due to a decline on the part of the old. Some explanations offered refer to sociocultural differences, educational differences, or cohort differences. Correlations between intelligence test scores and occupational groups showed the decline due to age to be less rapid among those engaged in intellectually stimulating activities (Akhurst, 1970). However, Foulds (1949) found the rate of decline in scores on the Raven Progressive Matrices Test from age 25 years onwards to be remarkably uniform and to be independent of the condition of employment.

It is possible that just as people age, so do cultures age. This being the case (Schaie, 1974), the perceived deficit of older people could simply be obsolescence in a rapidly changing sociocultural environment. Intelligence tests can never be viewed apart from the common cultural, educational heritage of the people being tested (Eysenck, 1971). Continued stimulation and education seem to play an important role in maintaining intellectual capacity in old age (Lugo & Hershey, 1974). Koos (1970) reviewed recent evidence of the correlation between education and scores on intelligence tests. Most of the evidence suggests there is little change in primary ability to learn through the adult years up to senility. In a review of some of the results from Project Talent, Flanagan (1975) had this to say, "It is obvious that education has made an enormous positive contribution to the quality of life of nearly all of these young people" (p. 15). These people who are 30 years old were generally satisfied with their status. They did indicate that developing their minds through learning was very important although only half of them were satisfied with their status in this regard.

In the lists of developmental tasks for man (Hurlock, 1968), references to intellectual skills are not found for early adulthood, middle age, or later maturity. This reflects the idea that by late adolescence, an individual has acquired most of the adult characteristics in the area of mental abilities (Knowles, 1969). In addition, the questions on tests of intelligence may have little or no relation to the occupations of adults or to adult life in general (Pressey & Kuhlen, 1957). On the other hand, when it comes to learning ability, older adults in all types of groups show equal or superior ability to their younger counterparts (Axford, 1969).

Results of early systematic studies of adult intelligence indicate a peak is reached between the ages of 20 to 25 years followed by a slow decline. Thorndike, Bregman, Tilton, and Woodyard (1928) went further to say, "Almost nothing has been known concerning the curve of intelligence in relation to age from twenty on to forty-five" (p. 155). The decline is fairly uniform from the peak to about 50 years of age. Jones and Conrad (1933) found a peak between 18 and 21 years followed by a gradual decline to age 55 using the Army Alpha Test. Miles and Miles (1932) assumed a plateau of ability or adult intelligence extending from a high point reached between the ages of 13 and 20 years. However, a downward trend of intelligence test scores as age increased was shown to be definitely a characteristic of both males and females. Raven (1948) using the Raven Progressive Matrices Test found:

> The capacity to . . . reason by analogy . . . appears to have reached its maximum somewhere

> about the age of 14, stays relatively constant for about 10 years and then begins to decline slowly but with remarkable uniformity. (p. 15)

Mean test scores on most intelligence scales cease to increase significantly beyond the age of 15 or 16 years. On the Wechsler Adult Intelligence Scale (WAIS), mean test scores tend to increase up to the age of 20 or 25 years. Wechsler (1958) viewed the increase between the age of 15 and 25 years, which is generally small, as due largely to the rise in the educational level and other factors rather than a real increment in sheer ability. These studies fall into the category known as cross-sectional investigations. Mental ability at various age levels is examined by comparing different groups of people, assuming that the dependent variable (mental ability) will not be affected by other factors except age, for large samples.

Longitudinal investigations measure the mental ability of the same individuals over a long period of time. These longitudinal studies give definite guides to the areas of intellectual development that are maintained, hold firm, or decline through the life span (Kreitlow, 1970). A longitudinal study reported by Owens (1953) showed no significant decrease in score on any subtest. This supports the possible existence of persisting motivational differentials. In a longitudinal study of gifted subjects by Bayley and Oden (1955), superior adults showed improvement in test scores between the ages of 20 and 50 years. The test was not speeded and called for knowledge of abstractions and relational thinking. Albert (1975) proposes that genius is not a function of the differences in measured intelligence. Lorge (1955) concluded that an over-concern for efficency in test performance by adults led to an underestimation of learning ability and intelligence. Declines in sensory acuity and physiological speed do characterize aging. However, the evaluation of learning ability and of intelligence must consider these abilities as more than the efficiency of the performance of specified tasks. In the Berkeley Growth Study (Eichorn, 1973), the overall trend from 16 to 36 years is an increase in mental ability, although females show a very slight decline after 26 years.

The bulk of research work on adult intelligence has featured the cross-sectional approach, but in the few studies where a longitudinal approach has been possible the results have sometimes contradicted those derived from cross-sectional studies (Bromley, 1966). Owens (1966) agrees that cross-sectional and longitudinal studies of the effects of age on mental abilities have yielded divergent and apparently contradictory results to date. In a review of cross-sectional and longitudinal studies of the effects of aging on reasoning ability (Chown, 1972), findings indicate overall that normal adults may show a decline in the capacity to reason logically with age, but that prior methods of problems solving are retained. Longitudinal studies of mental abilities have given more precise information about changes in individuals, although they have not resolved the problem of the criterion of adult intelligence (Birren, 1964). Wechsler (1975) cautions that, "Intelligence is not the same as aptitude and tests of intelligence are not the same as tests of mental ability" (p. 137).

There is a common belief that cross-sectional studies show a decline in intellectual abilities in later life but that longitudinal studies do not (Lunneborg et al., 1974). Baltes and Schaie (1973) report that substantial differences are found between the outcomes of cross-sectional and longitudinal studies. They point to the need of considering cultural and historical components when studying long term developmental trends. Kimmel (1974) agrees that cross-sectional findings have been contaminated by cultural and historical factors as well as pure age related changes such as a slowing down of performance speed. Visual acuity and performance under timing are subjects to marked decline during adult years. A decline in performance ability on a test of intelligence is, therefore, a function of age, and not necessarily of intelligence (Koos, 1970). The results of a study by Brinley, Jovick, and McLaughlin (1974) indicate a decline in reasoning scores beginning in the 36 to 50 year age group, with a greater decline after 50 years. Rhyne (1962) quoted data to support the inference that mental ability is not impaired as a function of age at least through the late 40's and early 50's. Savage, Britton, Bolton, and Hall (1973) criticized the assumption of many cross-sectional studies that intellectual ability would be affected only by age. They concluded that "intellectual functioning declines slowly from the third decade of life to the sixth and more abruptly thereafter" (p. 3).

The better schooling of today and the widespread use of objective tests in the schools are additional factors to be considered in reviewing the cross-sectional approach (Hurlock, 1968). Estes (1974) proposed, "from the time of Binet, the primary criterion for measuring intellect has been success in predicting performance in school and other situations requiring intellectual effort" (p. 740). On the other hand, Botwinick (1973) proposes that the major reason for the commonly held belief that longitudinal studies do not show declines in intelligence test scores with increasing age is a biased sample at terminal retest. There is a tendency for the initially less able to be less available for subsequent retesting than the initially more able which produces a biased sample.

In contrast with verbal tests, nonverbal tests such as the Raven Progressive Matrices Test, generally show decrements in average scores after mid-life (Birren, 1964). Verbal and nonverbal abilities are factorially independent when measured by relevant tests (Paivio, 1974). In a study by Schaie, Rosenthal, and Perlman (1953) it was demonstrated that there is a differential decline with reasoning abilities dropping at a much faster rate than the verbal abilities. This decline was apparent regardless of the speed factor. Lunneborg, et al. (1974) found that, with advancing age, older people, compared to younger people, have a verbal advantage and a quantitative disadvantage. Stafford (1972) concluded that aging produces a decrease in quantitative reasoning ability much in the same manner as it does in physiological processes but produces an increase in vocabulary.

The Raven Progressive Matrices Test is considered to be a pure measure of abstract reasoning (Cronbach, 1970) or fluid intelligence (Cunningham, Clayton, & Overton, 1975). Fluid intelligence should decline according to Birren (1974), "because it would represent a decline in the rapidity with which one can scan stored information and recombine it with current imput for a needed and perhaps novel response" (p. 812). Eysenck (1971) agrees that, "With age, fluid ability decreases, while crystallized ability stays much the same or may even increase" (p. 54). If groups of people from similar backgrounds aged twenty through seventy are tested on the Raven Progressive Matrices Test, the scores will show a steady linear decline from young to old (Chown, 1972). It appears as though intelligence of the kind measured by the Raven Progressive Matrices Test does decline steadily with age. Bromley (1966) agrees that the Raven Progressive Matrices Test is one of the best-known tests of relational thinking. Normal effects of aging on ability to do it are severe and even if unlimited time is allowed, age decrement is substantial.

Cattell (1971) claims that "the IPAT Culture Fair Tests . . . or Raven's matrices . . . [are] a relatively culture fair test and . . . satisfy the validity requirement of high loading on the fluid general intelligence factor" (p. 16). Rimland (1972) agrees that the Raven Progressive Matrices Test is apparently a nonverbal culture-free test, and is also one of the best available measures of g. Burt (1972) proposes a general factor entering into every type of cognitive process.

Test Bias

A number of respected investigators have argued persuasively that the tests commonly used to test intelligence and learning aptitude are not a fair test of adult ability (Demming & Pressey, 1957; Guilford, 1967; McClusky, 1964). The very nature of the tests used to assess adult intelligence may also contribute to the apparent decline that is sometimes observed (Baltes &

Schaie, 1974). Group tests, like individual tests, have a wide range of contents, serving different aims. Birren (1964) criticizes the tests because the content was developed for young people. Cronbach (1970) notes, "At one extreme is the Matrix test, so pure a measure of abstract reasoning . . . at the other extreme the ACT instrument draws its items almost directly from school lessons" (p. 281). Although most intelligence tests do not adequately measure adult intelligence, Bischof (1969) supports the apparent decline in performance of most adults in measurements of mental ability. Charles Cohen (1962) agrees that intelligence tests are not completely free of bias and tend to favor the individual with more education. The Raven Progressive Matrices Test is less dependent on education than most tests, although scores usually are depressed in cultures offering little compulsory education (Cronbach, 1970). In a study in East Africa (Silvey, 1972) the Raven Progressive Matrices Test was found to be a less educationally biased test than other tests. Dague (1972) found the Raven Progressive Matrices Test distinguished sharply between educated and uneducated persons of the same age in parts of Africa and Madagascar.

Timed tests. By contaminating power with speed measurements when testing adults, the true relationship of intellectual power to age may be obscured (Akhurst, 1970). For this reason, Lorge (1936) has been an advocate of using untimed tests in most areas with adult subjects. By removing the time limit, performance becomes better and hopefully reflects the true intellectual power of the older subject (Birren, 1974). However, in a study by Brinley, et al. (1974), clear cut evidence was found that older adults perform less adequately than younger persons in reasoning tasks. Since the problems involved were easy, results bore more on efficiency than on the power aspects of performance. One of the major criticisms of the studies relating mental abilities to age as measured by intelligence tests concerns the part played by the speed factor in the test, as opposed to the power factor (Cohen, C., 1962). Birren (1974) questions, "One did not know 30 years ago whether an intelligence test taken with or without time limits was a more valid indicator of that elusive quality we call intelligence" (p. 810). In order to measure adult learning effectively, it is necessary to control speed as a factor in test performance (Rhyne, 1962). In pilot trials using the Raven Progressive Matrices Test, the time limit was found to affect the mean test scores but not the rank of the subjects (Silvey, 1972). Akhurst (1970) supports the idea that time limits on some group tests such as the Raven Progressive Matrices Test are imposed largely for administrative convenience. However, Zubek and Solberg (1954) believe that since most tests include a speed factor, it is difficult, if not impossible, to state with any degree of certainty that a pure power test is unaffected by age. Compounding the difficulties of using a timed test with adults are the emotional and psychological effects of a timed limitation (Schonfield, 1974).

Test material. Most measures of intellectual ability used with adults have been adopted from measures used with children or young adults (Birren, 1973). Tests that are designed to appeal to children will not necessarily appeal to adults (Bergevin, 1967). Even when the tests have content appropriate for adults, the instruments themselves were devised for young people (Demming & Pressey, 1957). Pressey and Kuhlen (1957) agree that tasks may be weighted in favor of middle or upper socioeconomic individuals. The abilities being tested may not be used in the majority of adult occupations. Most measures of intellectual ability are based on the notion that intelligence is related to school achievement (Birren, 1973). Akhurst (1970) agrees and notes that most tests tend to be designed for upper ability range individuals and those who receive the intellectual stimulation of higher education. On the other hand, Cattell (1963) asked, "How fair is the Miller Analogies to engineering students competing for graduate school positions against English Majors, compared with a culture-fair test?" (p. 19). Using five tests of basic educational skills, Monge and Gardner (1974) found, "the farther an individual is in time from his early formal schooling, the poorer his performance on school-learned skills in the absence of specific practice" (p. 34). Backman (1972) found similar evidence in a review of portions of Project Talent. However, Neff (1972) suggests that actual life situations for adults differ from situations found on tests of mental ability. McClusky (1964) has voiced opposition to the usual intelligence test as a measure of adult ability on the grounds of its culture bias. Schaie (1974) believes that most group intelligence tests are inappropriate for older people because they were constructed for the members of a different cohort with different sociocultural exposure. Because of a possible culture bias, the traditional tests of cognitive skills will not be adequate for all adult students (Clarke & Ammons, 1970).

Test taking. Adults may not be test oriented. They are not conditioned to taking tests in the same way that children and adolescents are (Deem, 1968). Questions may be odd and confusing. Thus, according to Pressey and Kuhlen (1957), "In part because they sense their handicaps as test-takers, adults may often not cooperate as well as young people" (p. 78). It is hard to appraise how difficult an adult may find it to adapt to a test situation (Hollingworth, 1927; Kimmel, 1974; Ruch, 1934). Young adults have a decided advantage over the older generation because of their better schooling and the wide spread use of objective tests (Hurlock, 1968). Members of different generations may differ in their sophistication in test taking or their willingness to volunteer responses (Baltes & Schaie, 1974; Cohen, A., Brawer, & Lombardi, 1971). Akhurst (1970) agrees that older people will have had more restricted educational opportunities and in particular less experience with intelligence tests. Education and continued stimulation seem to play an important role in maintaining intellectual capacity in old age (Lugo & Hershey, 1974). The physical and emotional conditions of the subjects, the degree of motivation and the presence of anxiety can all affect the performance on a test (Chisholm, 1970). Monge and Gardner (1974) found anxiety independent of age but rigidity positively related to age. Bischof (1969) lists several other test taking attributes that adults should have in order to obtain a true measure of their intellectual ability. Adults should be interested in taking the test and persistent in performing the tasks. Cooperation during the testing and some familiarity with the test items are additional attributes that can affect the test performance of adults. Abul-Hubb (1972) in a study in Iraq using the Raven Progressive Matrices Test found, "secondary school and college students were more interested in taking this test, while illiterate and less able members of society did not cooperate easily" (p. 233). Akhurst (1970) suggests, "When tests [are] employed for research purposes . . . and where success brings no obvious benefits to the testee, it is wise to have some knowledge about his attitudes to procedure" (p. 91). Hurlock (1968) agrees that older people are at a decided disadvantage when taking an intelligence test. A lack of practice in writing and in reading during the adult years added to a tendency to slow down hampers the older person.

Female scores. The early literature implied that tests for intelligence were constructed to minimize differences between males and females (Birren, 1973). Because many of the tasks that might be used in tests of general intelligence are known to involve a gender bias, an appropriate selection of tasks can demonstrate male or female superiority (Nash, 1970). Birren (1964) did not find much evidence available on American populations regarding male-female differences in mental abilities with age. The available data suggest that females equal or slightly outperform men on verbal tests. Backman (1972) found that, "sex may play a greater role in the development or patterns of mental abilities than either ethnicity or SES" (p. 10). However, in longitudinal studies, serious consideration should be given to the greater survivorship of women. Numerous studies indicate the adult female to be consistently superior in tests involving verbal abilities and the adult male to be consistently superior in tests involving spatial abilities (Chisholm, 1970; Estes, 1974; Geist, 1968; Lunneborg, et al., 1974). In the Berkeley Growth Study (Eichorn, 1973), adults showed an overall increase in mental ability during the years 16 to 36. Females, however, showed a very slight decline after 26 years. Bromley (1966) suggested that women may be more prone to the effects of disuse with regard to mental abilities. On adult tests of intelligence, no significant difference between scores of males and females have been found sufficient to warrant separate standards of performance (Akhurst, 1970; Brinley et al., 1974). Ample evidence (Monge & Gardner, 1974) indicates that females in every decade rate themselves higher on anxiety measures. This anxiety could easily affect test performance. The cause of the anxiety may be traced to the desire on the part of many females for a change in their social and intellectual roles (Birren & Woodruff, 1973). Yet many tests contain numerous instances of bias towards females (Radloff, 1974; Saario, Jacklin, & Tittle, 1973).

Adult Education

In studying the effects of age on mental ability, it is important to evaluate the effects of education (Botwinick, 1973). The education of older people probably relied more heavily on principles of memorization and less heavily on those of problem solving (Baltes & Schaie, 1974). A comparison of older and younger adults on the basis of their scores in intelligence tests might not be scientifically sound, since there are differences in level of education, number of years out of school, and type of education between the two groups (Cohen, C., 1962). Raven (1948), found, "after the age of 30 a person's ability to understand a new method of thinking, adopt a new method of working, and even to adjust to a new environment, steadily decreases" (p. 16). On the other hand, Guilford (1967) says "Education is becoming more and more hazy as a variable, as the institution of adult education and opportunities for informal education become more general." (p. 459).

Learning occurs continuously within individuals whether or not any educational institution is involved (Hesburgh, Miller, & Wharton, Jr., 1973). Education of any type plays an important role in maintaining intellectual capacity in old age (Lunneborg, et al., 1974). With the increased tendency for adult education programs, it may be that the average intellectual level of the older population will increase (Lugo & Hershey, 1974). Schaie (1974) agrees that people can and do function at a high level throughout life, and thus can be expected to continue the educational process into very old age. Adult education would not be attempted if there were not a belief that adults can learn (Kreitlow, 1970). Birren and Woodruff (1973) stress the idea that, "the orientation of educational institutions must be altered from one of exclusive concern with the first two decades of life to involvement with education over the entire human life span" (p. 306).

It is a commonly held belief that as people grow older they become less adaptable (Chown, 1961; Knowles, 1969). There is evidence that adults in their early 20's begin to have measurable losses in eyesight, hearing, and the body's ability to adjust to extremes of all kinds. Earlier investigators neglected to take into account the many ways in which the adult compensates for what little sensory loss does occur (Ulmer, 1969). When all factors are taken into account, the adult's ability to learn and adjust to his environment may improve in spite his deteriorating physical capacities. Glass and Harshberger (1974) put it succinctly, "Despite any perceivable inflexibility which generally might accrue with age, man is an extremely adaptable animal" (p. 217).

Extensive and up-to-date information about the adult learner is badly needed. During the 1980's may come the era of the pre-middle-agers in their late 20's to mid 30's who will enter higher education (Berendzen, 1974). At the present time, adult students are the new majority in higher education in the United States (Fischer, 1974). Groesch (1974) found that women are almost equally enrolled with men in community colleges and "their needs may represent new educational goals" (p. 52). Continuing education over the life span is not only desirable, it is a necessity (Birren & Woodruff, 1973). Subsequent cohorts of aged individuals will be increasingly interested in education. Looking at present trends, Quie (1975) concluded that community colleges could soon be serving over half of the adult population pursuing formal education and training.

Recapitulation

The preceding discussion emphasized the discrepancies among studies of intellectual change with age. Cross-sectional investigations have usually found a decline in intellectual abilities in later life. The age of the initial decline varies from study to study with the earliest age in the 20's and the latest age in the 50's. Longitudinal investigations have produced results that seem to contradict the findings of the cross-sectional investigations. Some longitudinal studies have produced results indicating an increase in mental ability through the 30's or even into the 50's. One area of concern is what an intelligence test really tests in older subjects. Is it possible to study changes in mental ability in relation to age without considering other factors such as the test being used? Savage, et al., (1973) lists the Wechsler-Bellevue and the WAIS as the most widely used tests for studies of the aged. Appearing next in order of precedence are the Raven Progressive Matrices Test and the Mill Hill Vocabulary Scale. In England, Slater (1948) found the Raven Progressive Matrices Test ranking second only to Binet's as a test of general intelligence.

Various aspects of adult intelligence can be tested by a careful selection of the test instrument. This in turn can affect the test results. Crystallized intelligence usually reflects the verbal part of intelligence. Results of many studies indicate that this type of intelligence holds firm or increases during the life span. On the other hand, fluid intelligence or abstract reasoning ability, appears to decline steadily from a peak in the 20's. Most studies of fluid intelligence employ a nonverbal test of reasoning, such as the Raven Progressive Matrices Test. Related to the selection of a test instrument is the question of test bias. Is the material on a test appropriate for adults? Does the test material simply reflect an amount of formal education? Other factors may also affect the scores obtained by adults on tests of mental ability. Are adults emotionally and psychologically prepared to take an intelligence test? The time limits used with many tests can be upsetting to older people. The testing situation can require new types of responses with which the adults are not familiar. Is there a bias towards females built into tests of mental ability? Females traditionally score better on verbal tests of intelligence.

The present study suggests that a nonverbal test of intelligence be used to attempt a study of the intellectual change of adults with age. Use of a nonverbal test should help to control any effects of education or schooling. Use of a pretesting session or presession can possibly help control some of the emotional or psychological factors that adults bring to a testing situation. The bias towards females should be controlled by using the Raven Progressive Matrices Test.

The implications of studies of this type are related to the growth of adult education in all its forms. Adults are flocking back to the classrooms in adult education courses and also in regular baccalaureate programs. If adults are to be admitted to colleges and universities as regular students, ways must be found to adequately test them. Are there ways to assist adults in learning test taking techniques. The presession used in this study might be one approach to help adults overcome their fears and anxieties related to testing.

CHAPTER III

METHOD

Hypotheses Tested

The principal purpose of this study was to test the following research hypotheses:

1. Subjects who attend a presession will score higher on the Raven Progressive Matrices Test than those who do not attend a presession.

2. Older subjects will score lower on the Raven Progressive Matrices Test than younger subjects.

3. Female subjects will score lower on the Raven Progressive Matrices Test than male subjects.

4. The difference in test scores on the Raven Progressive Matrices Test between those attending a presession and those not attending will be greater for older subjects than for younger subjects.

5. The difference in test scores on the Raven Progressive Matrices Test between those attending a presession and those not attending will be greater for female subjects than for male subjects.

6. The difference in test scores on the Raven Progressive Matrices Test between male and female sub-

jects will be greater for older subjects than for younger subjects.

Subjects

The subjects of the present study were enlisted from the students enrolled in various credit and adult-credit courses at Triton College, a community college in River Grove, Illinois. Additional subjects consisted of friends and relatives of the students. The testing was publicized generally throughout the Triton campus by means of posters and word of mouth. In particular, students enrolled in the Individual Mathematics Program were advised of the testing. To encourage participation in the testing, each student in the Individual Mathematics Program who volunteered received credit for one test in his course. The typical course in the Individual Mathematics Program consists of 15 tests that must be passed in order to receive a grade of A for the course. As a further inducement and to obtain a wide range of ages, each student in the Individual Mathematics Program could receive credit for a second test in his course. This was accomplished by bringing in another volunteer of a different age.

A total of 240 subjects (120 females and 120 males) participated in the testing program. Subjects were listed by age and gender when they registered for the program. Four age groups were determined, 15 years to 18 years, 19 years to 22 years, 23 years to 29 years, and 30 years to 69 years (all age groups inclusive). Then within the age-gender groups the subjects were randomly assigned to control or experimental groups. This process yielded a total of 16 groups (see Table 1) with 15 subjects in each group. Information on the age spread for all subjects in the study is presented in Figure 1. Figures 2 and 3 illustrate the age spread for the subjects stratified by presession attendance. Figures 4 and 5 present the age spread for subjects stratified by gender.

The first age group consisted of subjects aged 15 years to 18 years. These subjects included college freshmen, high school students enrolled in courses at Triton College, high school dropouts, and a few subjects who had never completed a formal elementary education. The second age group consisted of subjects aged 19 years to 22 years. These subjects included the college students who normally would be in college if

Table 1

Classification of Subjects by Age, Gender, and Attendance at a Presession

	Presession	
Age[a]	No	Yes
15 - 18		
female	1	9
male	2	10
19 - 22		
female	3	11
male	4	12
23 - 29		
female	5	13
male	6	14
30 - 69		
female	7	15
male	8	16

Note. Each group contained 15 subjects.

[a]Ages are inclusive, in years.

```
HISTOGRAM ON D
                     STEP=      5.00000000
                     CENTERPOINT OF INITIAL GROUP=    15.00000000          NO. OF OBSERVATIONS=  240
                     CENTERPOINT OF FINAL GROUP=    70.00000000          NO. OF GROUPS=   12
                     K FACTOR=    2.

PERCENTAGE  0         10        20        30        40        50        60        70        80        90        100
            +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
            OIIIIIIIIIIIIIII                                                                                    +
  .150+02   OIIIIIIIIIIIIIII                                                                                    I
            OIIIIIIIIIIIIIII                                                                                    +
            OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                 +
  .200+02   OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                 I
            OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                 +
            OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                              +
  .250+02   OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                              I
            OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                              +
            OIIIIIIIIIIIIIIIIIIIIII                                                                              +
  .300+02   OIIIIIIIIIIIIIIIIIIIIII                                                                              I
            OIIIIIIIIIIIIIIIIIIIIII                                                                              +
            OIIIIIIIIII                                                                                          +
  .350+02   OIIIIIIIIII                                                                                          I
            OIIIIIIIIII                                                                                          +
            OIIIIIIIIIIII                                                                                        +
  .400+02   OIIIIIIIIIIII                                                                                        I
            OIIIIIIIIIIII                                                                                        +
            OI                                                                                                   +
  .450+02   OI                                                                                                   I
            OI                                                                                                   +
            OIIII                                                                                                +
  .500+02   OIIII                                                                                                I
            OIIII                                                                                                +
            O                                                                                                    +
  .550+02   O                                                                                                    I
            O                                                                                                    +
            O                                                                                                    +
  .600+02   O                                                                                                    I
            O                                                                                                    +
            O                                                                                                    +
  .650+02   O                                                                                                    I
            O                                                                                                    +
            O                                                                                                    +
  .700+02   O                                                                                                    I
            O                                                                                                    +
            +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
PERCENTAGE  0         10        20        30        40        50        60        70        80        90        100
```

Figure 1. Histogram of ages

```
HISTOGRAM ON D WITH B=2
        STEP=        5.00000000
        CENTERPOINT OF INITIAL GROUP=     15.00000000          NO. OF OBSERVATIONS=  120
        CENTERPOINT OF FINAL GROUP=     60.00000000          NO. OF GROUPS=   10
        K FACTOR=     2.
```

Figure 2. Histogram of ages for adults attending presession.

```
HISTOGRAM ON D WITH B=1
                STEP=      5.00000000
                CENTERPOINT OF INITIAL GROUP=     15.00000000          NO. OF OBSERVATIONS=  120
                CENTERPOINT OF FINAL GROUP=    70.00000000          NO. OF GROUPS=    12
                K FACTOR=     2.

PERCENTAGE     0         10        20        30        40        50        60        70        80        90        100
               +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
               OIIIIIIIIIIIIIIIIIIII                                                                               +
      .150+02  OIIIIIIIIIIIIIIIIIIII                                                                               I
               OIIIIIIIIIIIIIIIIIIII                                                                               +
               OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                      +
      .200+02  OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                      I
               OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                      +
               OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                              +
      .250+02  OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                              I
               OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                              +
               OIIIIIIIIIIIIIIIIIIII                                                                               +
      .300+02  OIIIIIIIIIIIIIIIIIIII                                                                               I
               OIIIIIIIIIIIIIIIIIIII                                                                               +
               OIIIIIIIIIIIII                                                                                      +
      .350+02  OIIIIIIIIIIIII                                                                                      I
               OIIIIIIIIIIIII                                                                                      +
               OIIIII                                                                                              +
      .400+02  OIIIII                                                                                              I
               OIIIII                                                                                              +
               O                                                                                                   +
      .450+02  O                                                                                                   I
               O                                                                                                   +
               OIIIIIII                                                                                            +
      .500+02  OIIIIIII                                                                                            I
               OIIIIIII                                                                                            +
               OII                                                                                                 +
      .550+02  OII                                                                                                 I
               OII                                                                                                 +
               O                                                                                                   +
      .600+02  O                                                                                                   I
               O                                                                                                   +
               O                                                                                                   +
      .650+02  O                                                                                                   I
               O                                                                                                   +
               O                                                                                                   +
      .700+02  O                                                                                                   I
               O                                                                                                   +
               +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
PERCENTAGE     0         10        20        30        40        50        60        70        80        90        100
```

Figure 3. Histogram of ages for adults not attending presession.

```
HISTOGRAM ON D WITH C=1
                STEP=      5.00000000
                CENTERPOINT OF INITIAL GROUP=    15.00000000        NO. OF OBSERVATIONS=  120
                CENTERPOINT OF FINAL GROUP=     65.00000000        NO. OF GROUPS=    11
                K FACTOR=     2.
```

Figure 4. Histogram of ages for females.

```
HISTOGRAM ON D WITH C=2
          STEP=       5.00000000
          CENTERPOINT OF INITIAL GROUP=    15.00000000         NO. OF OBSERVATIONS=  120
          CENTERPOINT OF FINAL GROUP=    70.00000000          NO. OF GROUPS=   12
          K FACTOR=     2.
```

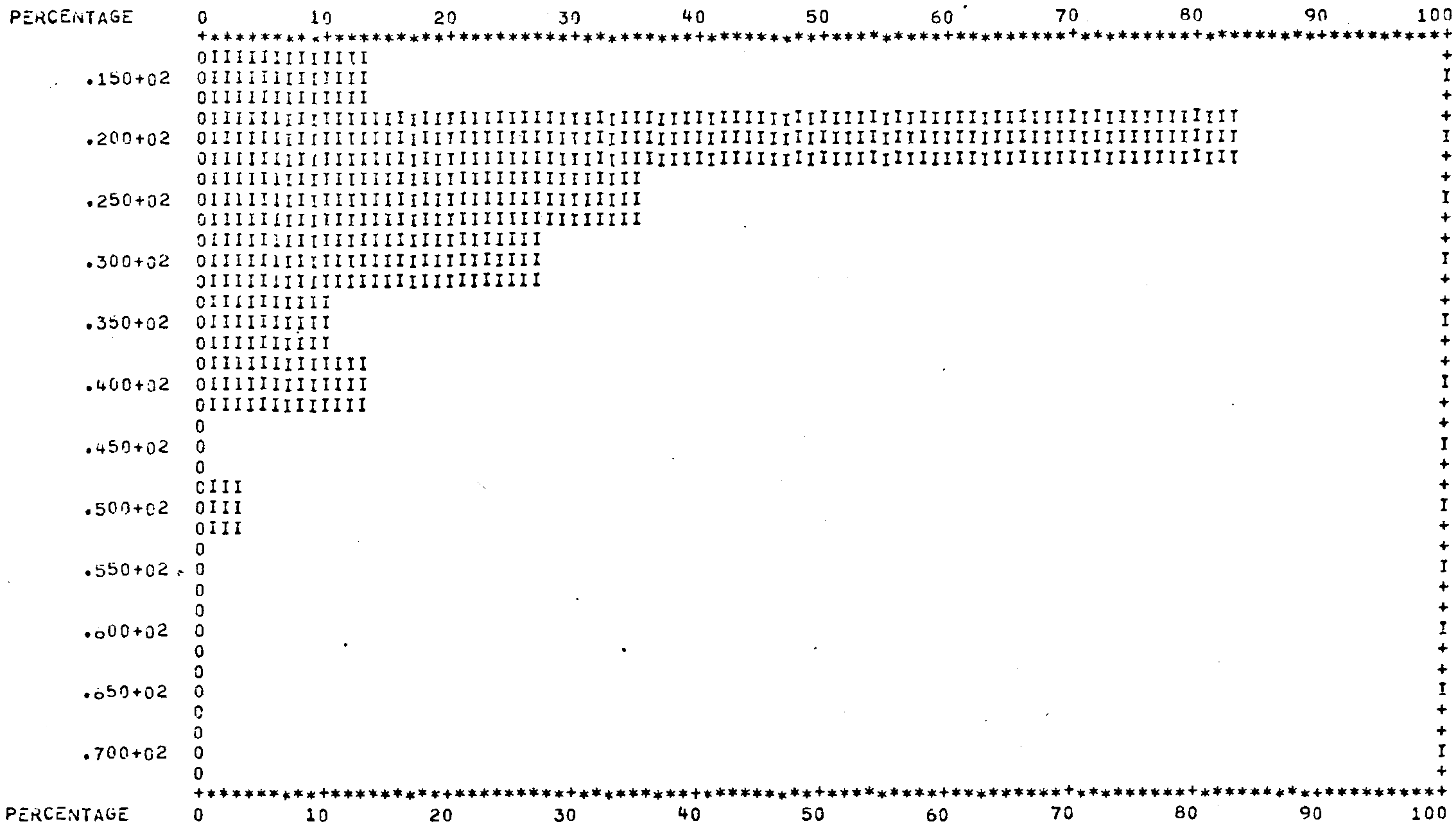

Figure 5. Histogram of ages for males.

there were no interruption in proceeding from high school into college. The third age group consisted of subjects aged 23 years to 29 years. These subjects included college students at all levels and a few subjects holding baccalaureate degrees. The fourth and last group consisted of subjects aged 30 years to 69 years. The educational level of these subjects ranged from elementary school graduates to holders of advanced degrees. There were high school graduates as well as high school dropouts.

To encourage all subjects to obtain the highest possible score on the test, a lottery-type contest for prizes was advertised on the publicity posters and made known to the volunteers when they initially signed up for the testing program. The contest for prizes was announced again immediately before the testing. Each subject received one chance for each point or correct answer obtained on the test. The Raven Progressive Matrices Test has a maximum of 60 problems and thus each subject could possibly receive 60 chances. The awards consisted of 25 prizes of $2 with subjects eligible for more than one prize. The drawing for prizes was held immediately after the last testing session. Prizes were awarded at that time to the winners present with the remaining prizes being mailed to the winners.

Procedure

The Raven Progressive Matrices Test was administered to the control group as an untimed test. The experimental group attended a presession, immediately followed by the administration of the untimed Raven Progressive Matrices Test. To control for any possible bias on the part of the experimenter in the administration of the test or the presession, aides were enlisted to assist in the testing program. Duties of the student aides working in the Individual Mathematics Program at Triton College include giving directions for taking tests and running slide-tape presentations for beginning students. Two of the student aides received further training in the procedures for administering the Raven Progressive Matrices Test and for running the presession. These two student aides worked during all parts of the testing program.

Instrument. The Raven Progressive Matrices Test is a test of a person's capacity to observe meaningless figures, to see the relations between them, and to complete each system of relations. A general English opinion (Burke, 1958) is that the Raven Progressive Matrices Test is perhaps the best of all nonverbal tests of g. Burke (1958) found abundant evidence of the concurrent validity for the Raven Progressive Matrices Test, "in the sense of its capacity to discriminate over a wide range among groups known by other criteria to differ in intellectual capacity" (p. 210). In a recent study by Cunningham, et al. (1975), the Raven Progressive Matrices Test was employed as an index of fluid intelligence, in a comparison with the WAIS, an index of crystallized intelligence. The tests were untimed and administered individually to subjects from two different age groups. Scores on the WAIS and the Raven Progressive Matrices Test were correlated for each age group, and these correlations were found to be significantly different. Raven (1960) proposed that a person's total score on the Raven Progressive Matrices Test, "provides an index of his intellectual capacity whatever his nationality or education" (p. 1). The normal effects of aging on ability to do such a test are severe and, even if unlimited time is allowed, age decrement is substantial

(Bromley, 1966). Chown (1961) found the apparent decline in the ability of older subjects to carry out the Raven Progressive Matrices Test could be attributed to a lack of ability to shift ideas or to a slower speed of performing the tasks.

The Raven Progressive Matrices Test consists of 60 problems divided into five sets of 12 problems. The problems become progressively more difficult although the first problem in each set is as self-evident as possible. The procedure for administering the Raven Progressive Matrices Test uses problem one of set A for a demonstration problem. Directions are given for finding the right pattern and for inserting the answer in the proper box on the answer sheet. Subjects are then asked to attempt problem two of set A. After a suitable length of time, the answer for this problem is checked. All subjects taking this test will therefore have a minimum score of two. The score for each subject is the total number of correct answers recorded on the answer sheet with a maximum of 60.

<u>Presession.</u> The presession consisted of a slide-tape presentation (see Appendix A) that lasted approxi-

mately six minutes. Six questions were posed by cartoon characters and answered on the tape. The questions asked were the following:

1. Why should I try my best?
2. When should I ask questions?
3. Why should I follow directions?
4. When should I guess?
5. How do I mark the answers?
6. How do I relieve tension?

These questions were formulated to explore the areas of test taking with which adults are sometimes unfamiliar. The slide-tape presentation was produced in a semi-humorous vein so as to help relieve the tensions and anxieties that are often present in an adult testing situation.

Variables

On the answer sheet used with the test, each subject recorded his age and gender. In addition, each subject was requested to list the total number of years of formal education he had. After the answer sheets were handed in, attendance or nonattendance at a presession was noted for each subject. For the purpose of this study then the dependent variable is the test score obtained by each subject. The independent variables are attendance at a presession, gender, age, and educational level.

CHAPTER IV

RESULTS

The general aim of this research was to determine if adults who attend a presession will score higher on the Raven Progressive Matrices Test than the adults who do not attend a presession. Figure 6 presents an overall view of the test scores obtained in this study. The means and variances for the 16 groups, all subjects stratified by presession, gender, and age, are presented in Table 2. Additional data for different groupings of the subjects are presented in Table 3 as well as Figures 7, 8, 9, and 10.

The first analysis performed consisted of the calculation of a 2 x 2 x 4 analysis of variance on the test scores as a function of presession attendance, gender, and age (see Table 4). The analysis of variance indicated a significant presession effect, F (1,224) = 7.03, $p < .01$.

To test the research hypothesis that adults attending a presession will score higher on the Raven Progressive Matrices Test than adults not attending a presession, data in Tables 3 and 4 should be examined. The

```
HISTOGRAM ON A
          STEP=     5.00000000
          CENTERPOINT OF INITIAL GROUP=     5.00000000          NO. OF OBSERVATIONS=  240
          CENTERPOINT OF FINAL GROUP=    60.00000000          NO. OF GROUPS=   12
          K FACTOR=    2.
```

Figure 6. Histogram of test scores.

Table 2

Mean Test Scores and Variances of Subjects Stratified by Presession, Gender, and Age

Group[a]	Nonpresession		Presession	
	Mean	Variance	Mean	Variance
Females				
15 to 18	49.53	62.41	55.00	7.57
19 to 22	52.27	17.21	48.80	71.74
23 to 29	48.87	53.98	51.00	107.57
30 to 69	49.07	39.78	49.53	88.98
Males				
15 to 18	49.13	45.84	52.87	28.55
19 to 22	53.20	19.46	55.47	9.69
23 to 29	52.00	36.00	53.13	18.41
30 to 69	42.80	272.46	52.06	61.64

Note. For the total group, the mean = 50.92 and the variance = 63.97.

[a]Ages are inclusive, in years.

Table 3

Mean Test Scores and Variances of Subjects Stratified by Presession, Gender, or Age

Group	Mean	Variance
Presession		
No	49.61	73.58
Yes	52.23	51.41
Gender		
Females	50.51	57.03
Males	51.33	71.10
Age[a]		
15 to 18	51.63	40.24
19 to 22	52.43	33.88
23 to 29	51.25	53.75
30 to 69	48.37	121.66

Note. For the total group, the mean = 50.92 and the variance = 63.97.

[a]Ages are inclusive, in years.

```
HISTOGRAM ON A WITH B=2
          STEP=      5.00000000
          CENTERPOINT OF INITIAL GROUP=    20.00000000        NO. OF OBSERVATIONS=  120
          CENTERPOINT OF FINAL GROUP=    60.00000000        NO. OF GROUPS=    9
          K FACTOR=    2.
```

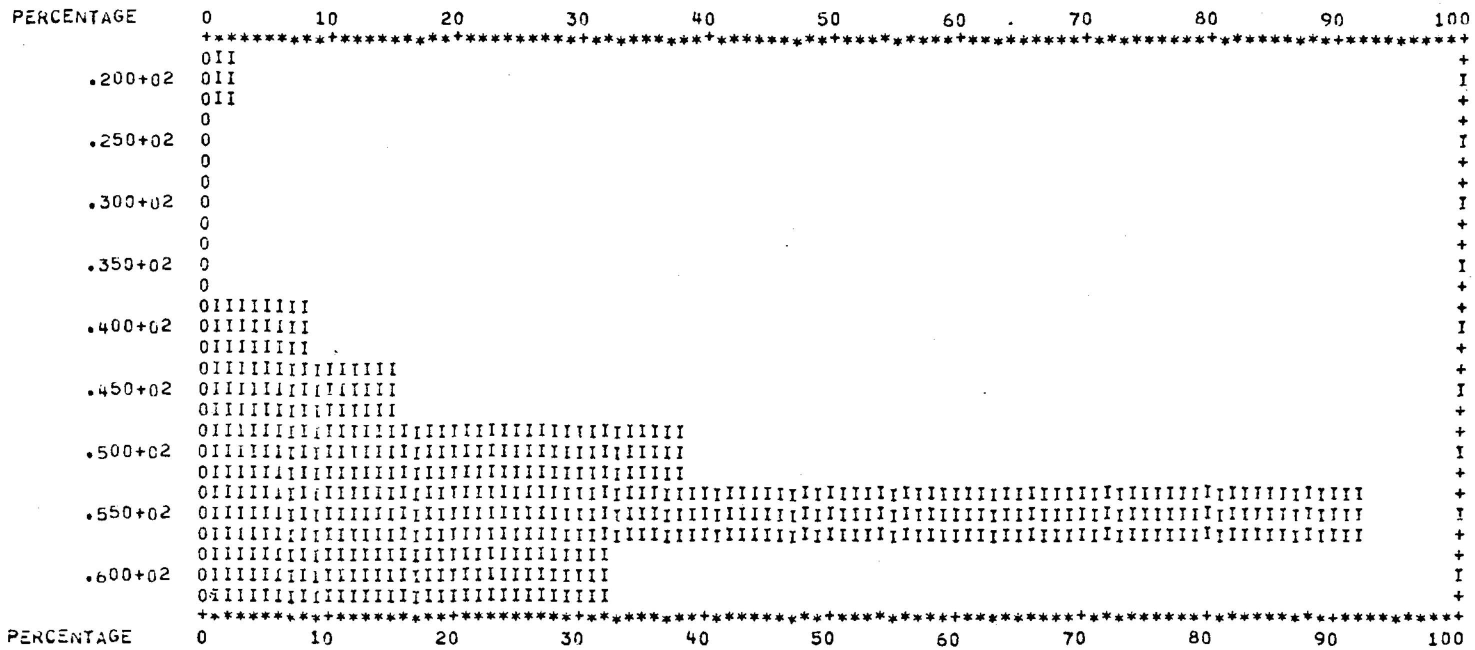

Figure 7. Histogram of test scores for adults attending presession.

```
HISTOGRAM ON A WITH B=1
                STEP=      5.00000000
                CENTERPOINT OF INITIAL GROUP=     5.00000000          NO. OF OBSERVATIONS=  120
                CENTERPOINT OF FINAL GROUP=    60.00000000          NO. OF GROUPS=   12
                K FACTOR=    3.
```

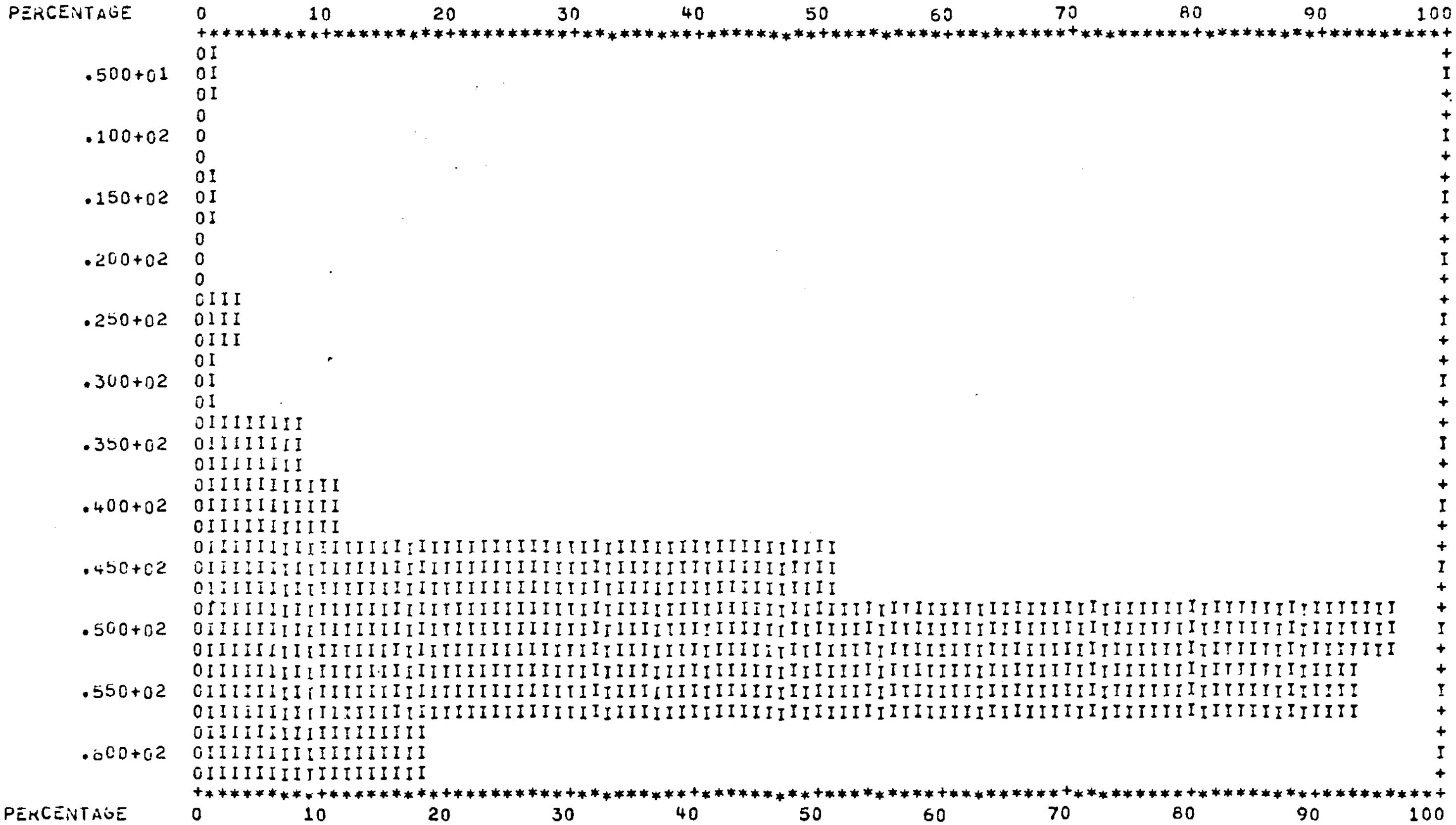

Figure 8. Histogram of test scores for adults not attending presession.

```
HISTOGRAM ON A WITH C=1
          STEP=        5.00000000
          CENTERPOINT OF INITIAL GROUP=    20.00000000      NO. OF OBSERVATIONS=  120
          CENTERPOINT OF FINAL GROUP=    60.00000000       NO. OF GROUPS=    9
          K FACTOR=    2.
```

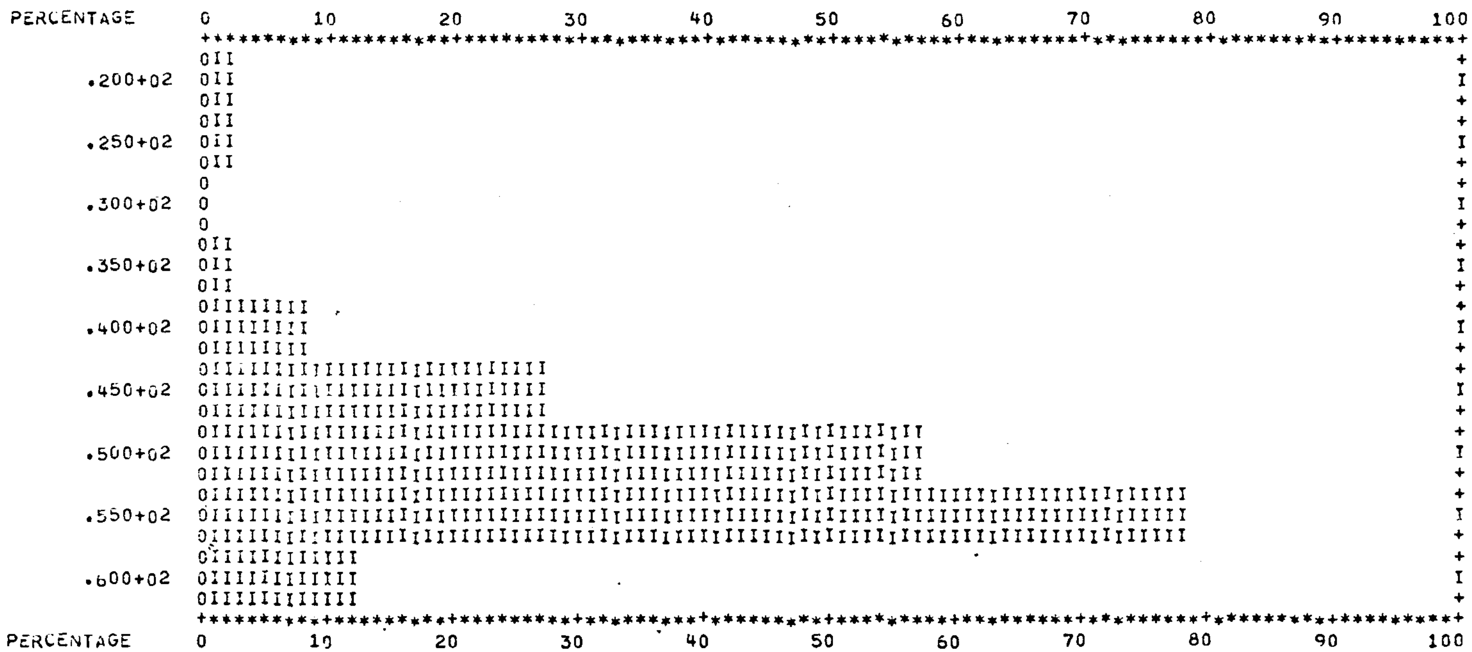

Figure 9. Histogram of test scores for females.

```
HISTOGRAM ON A WITH C=2
                    STEP=      5.00000000
                    CENTERPOINT OF INITIAL GROUP=     5.00000000          NO. OF OBSERVATIONS=  120
                    CENTERPOINT OF FINAL GROUP=    60.00000000          NO. OF GROUPS=   12
                    K FACTOR=     2.
```

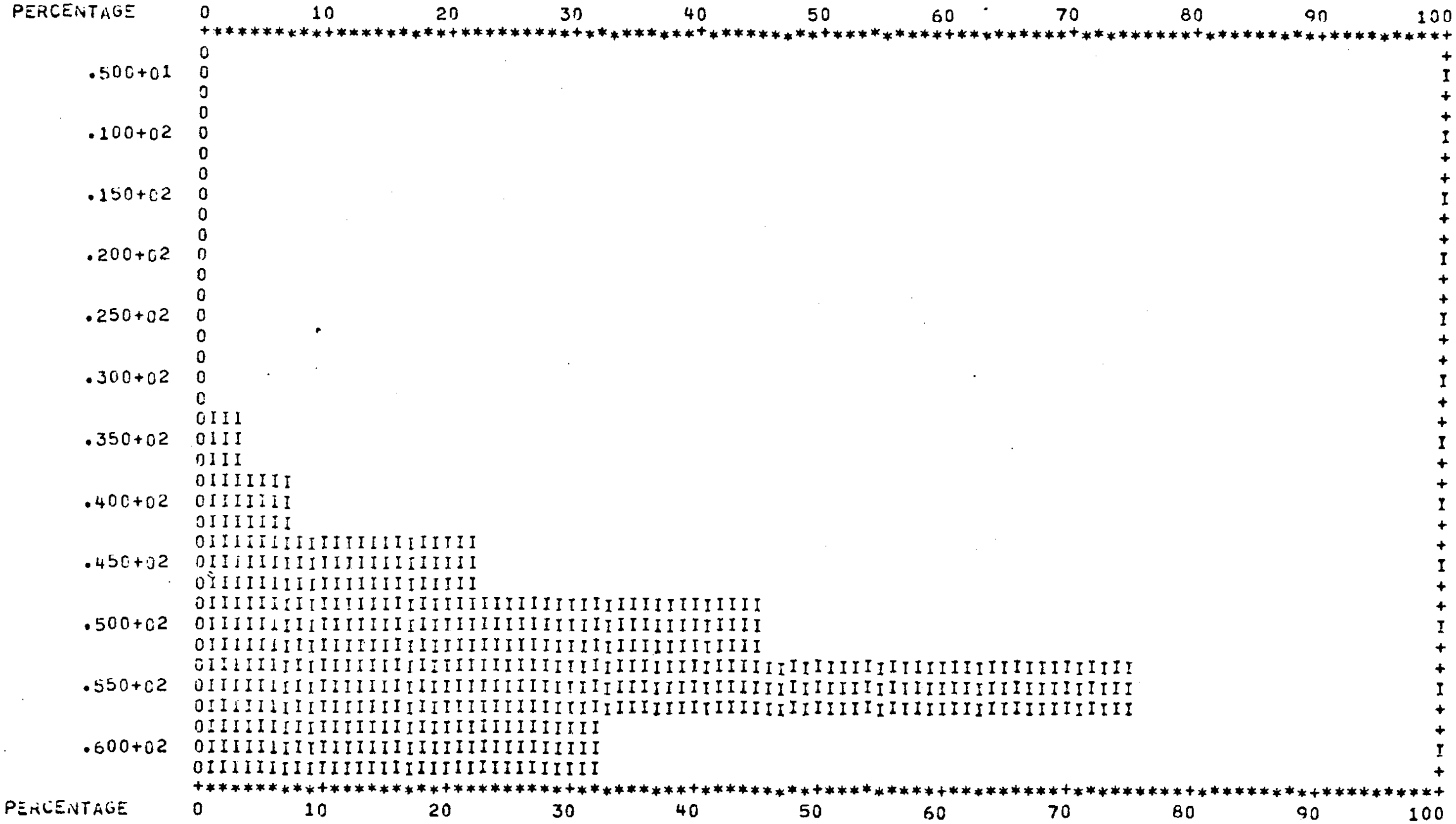

Figure 10. Histogram of test scores for males.

Table 4

Analysis of Variance for Test Scores as a Function of Presession, Gender, and Age

Source	df	MS	F
Presession	1	413.44	7.03**
Gender	1	40.85	.69
Age	3	188.55	3.21*
Presession x gender	1	130.52	2.22
Presession x age	3	101.55	1.73
Gender x age	3	118.70	2.02
Presession x gender x age	3	99.39	1.69
Error	224	58.83	

* $p < .025$

** $p < .01$

mean test score on the Raven Progressive Matrices Test for subjects attending a presession (mean = 52.23) is higher than the mean test score for subjects not attending a presession (mean = 49.61). The analysis of variance demonstrates that there is a significant difference in score on the Raven Progressive Matrices Test for those attending a presession as opposed to those not attending a presession. An interpretation of these data indicates that the first research hypothesis can be accepted.

A secondary aim of this study was to determine, if possible, whether an intellectual incline, plateau, or decline is associated with increasing age. To test the research hypothesis that older subjects will score lower on the Raven Progressive Matrices Test than younger subjects, data in Tables 3 and 4 should be examined. The analysis of variance demonstrates that there is a significant difference in score on the Raven Progressive Matrices Test related to age, $\underline{F}$ (3,224) = 3.21, $\underline{p} < .025$. The mean test scores on the Raven Progressive Matrices Test for the four age groups do not show a continuous increase or decrease.

To test the difference in mean test scores for each pair of age groups, both the t test and Duncan's

Multiple Range Test were calculated (see Table 5). The t test is often used as an a priori comparison or after an F ratio is found to be significant. A more powerful test procedure is Duncan's Multiple Range Test used as an a posteriori comparison. The results for both tests are found to be identical. For p = .05, there are three significant differences, all of which involve the group aged 30 to 69 years. However, for p = .01, there is only one significant difference between the group aged 19 to 22 years and the group aged 30 to 69 years. The second research hypothesis that older adults will score lower on the Raven Progressive Matrices Test than younger adults can only be accepted with reservations.

The results of this study thus far do not give a clear picture of the effect of age upon test score. To try and clarify the situation, a test for orthogonal components for the age variable was performed (see Table 6). The results are interpreted as showing that the data can best be described mathematically as a straight line. The quadratic and cubic components are not significant indicating that apparently the data are not represented by a curve. Since the test for linear trend was significant, the next decision to be made is what type of

Table 5

The t Test and Duncan's Multiple Range Test for Differences in Mean Test Scores of Age Groups

Group[a]	Difference of Means	Duncan's Test	t Test
(30-69) vs. (19-22)	4.06	**	**
(30-69) vs. (15-18)	3.26	*	*
(30-69) vs. (23-29)	2.88	*	*
(23-29) vs. (19-22)	1.18		
(23-29) vs. (15-18)	.38		
(15-18) vs. (19-22)	.80		

[a]Ages are inclusive, in years.

* p = .05

** p = .01

Table 6

Test for Orthogonal Components

for the Age Variable

Source of variation	df	MS	F
Between	3	188.55	3.02*
Linear	1	361.90	5.80**
Quadratic	1	203.50	3.26
Cubic	1	.24	.00
Within	236	62.38	

* $p < .05$

** $p < .025$

straight line is formed. If there is a decrement of test score with age, then the straight line should be oblique downward. The mean test scores on the Raven Progressive Matrices Test for the three youngest age groups are 51.63, 52.43, and 51.25 from youngest to oldest (see Table 3). It was also found that these three mean test scores were not significantly different (see Table 5). A mathematical conclusion would be that the linear trend for the age factor is a horizontal line. However, it is difficult to conclude that there is an intellectual plateau associated with increasing age without considering other factors connected with this research. If a greater number of subjects in the age group 30 to 69 years were included, the results might have been different. Apparently there is no intellectual incline with increasing age, and possibly a decline or plateau.

Another aim of this study was to determine, if possible, if the difference in test scores for between males and females is significant. The mean test score on the Raven Progressive Matrices Test for female subjects (mean = 50.51) is lower than the mean test score for male subjects (mean = 51.33). However, the difference is found to be not significant in the analysis of variance (see Table 4). Therefore, the third research hypothesis that the female subjects will score lower on the Raven Progressive Matrices Test than the male subjects can be rejected.

The fourth research hypothesis to be examined in this study is that the difference in mean test scores on the Raven Progressive Matrices Test between those attending a presession and those not attending a presession will be greater for older subjects than for younger subjects. The means and variances for subjects stratified by presession and age are presented in Table 7. The analysis of variance (see Table 4) showed that attendance at a presession was a significant factor. To differentiate, t tests were compiled for differences in mean test scores of presession vs. nonpresession subjects stratified by age group (see Table 8). The results indicate that for the youngest age group (15 to 18 years) there is a significant difference in test scores of those attending a presession and those not attending a presession. For all other age groups, the difference in mean test scores is not significant. Therefore the fourth research hypothesis can be rejected. Younger

Table 7

Mean Test Scores and Variances of Subjects Stratified by Presession and Age

Group[a]	Mean	Variance
Nonpresession		
15 to 18	49.33	52.30
19 to 22	52.73	17.93
23 to 29	50.43	45.98
30 to 69	45.93	160.89
Presession		
15 to 18	53.93	18.62
19 to 22	52.13	50.81
23 to 29	52.07	62.00
30 to 69	50.80	74.37

Note. For the total group, the mean = 50.92 and the variance = 63.97.

[a]Ages are inclusive, in years.

Table 8

The t Test for Differences in Mean Test Scores of Presession vs. Nonpresession Subjects Stratified by Age

Group[a]	t
15 to 18	2.99*
19 to 22	.40
23 to 29	.86
30 to 69	1.74

[a]Age is inclusive, in years.

* p = .01

rather than older subjects have a significant difference in test scores on the Raven Progressive Matrices Test between those attending a presession and those not attending a presession.

The means and variances for subjects stratified by presession and gender are presented in Table 9. The fifth research hypothesis to be examined in this study is that the difference in mean test scores on the Raven Progressive Matrices Test between those attending a presession and those not attending a presession will be greater for female subjects than for male subjects. The results of t tests for differences in mean test scores of presession vs. nonpresession subjects stratified by gender appear in Table 10. For female subjects there is no significant difference. However, for male subjects, the difference in mean test scores between those attending a presession and those not attending a presession is significant. Therefore, the fifth research hypothesis is rejected.

The sixth research hypothesis to be examined in this study is that the difference in mean test scores on the Raven Progressive Matrices Test between male and female subjects will be greater for older subjects than

Table 9

Mean Test Scores and Variances of Subjects

Stratified by Presession and Gender

Group	Mean	Variance
Nonpresession		
Females	49.93	43.05
Males	49.28	105.16
Presession		
Females	51.08	71.30
Males	53.38	29.70

Note. For the total group, the mean = 50.92 and the variance = 63.97.

Table 10

The t Test for Differences in Mean Test Scores of Presession vs. Nonpresession Subjects Stratified by Gender

Group	t
Females	.83
Males	2.73*

* p = .01

for younger subjects. The means and variances for subjects stratified by gender and age are presented in Table 11. The results of t tests for differences in mean test scores of female vs. male subjects stratified by age appear in Table 12. For subjects in the age group 19 to 22 years, the difference in mean test scores between males and females is significant. For all other age groups, the difference between female and male mean test scores is not significant. Since the only age group to show a significant difference in mean test scores between female and male subjects was one of the younger groups, the sixth research hypothesis is rejected.

A final area of consideration for this study is the effect of the educational level of a person upon his performance on the Raven Progressive Matrices Test. It might be expected that the older subjects would have fewer years of formal education. In this study, the younger subjects had fewer years of education (see Table 13). The majority of subjects had 12 to 14 years of formal education (see Figure 11). Guilford (1967) was prophetic when he claimed that education as a variable is becoming more hazy as a consequence of the growth of

Table 11

Mean Test Scores and Variances of Subjects

Stratified by Gender and Age

Group[a]	Mean	Variance
Females		
15 to 18	52.27	41.51
19 to 22	50.53	46.05
23 to 29	49.93	79.17
30 to 69	49.30	62.22
Males		
15 to 18	51.00	39.52
19 to 22	54.33	15.40
23 to 29	52.57	26.60
30 to 69	47.43	162.81

Note. For the total group, the mean = 50.92 and the variance = 63.97.

[a]Ages are inclusive, in years.

Table 12

The t Test for Differences in Mean Test Scores of Female vs. Male Subjects Stratified by Age

Group[a]	t
15 to 18	.77
19 to 22	2.66*
23 to 29	1.41
30 to 69	.68

[a]Age is inclusive, in years.

* $p = .01$

Table 13

Number of Subjects in Each Age Group Stratified by the Educational Level

Education	15-18	19-22	23-29	30-69
5	1			
6	2			
7	2			
8	2			2
9				
10	1			5
11	8			
12	17	15	13	13
13	21	24	23	13
14	5	17	14	21
15	1	4	5	2
16			3	1
17			1	
18			1	2
19				
20				1

Note. Ages and education are in years.

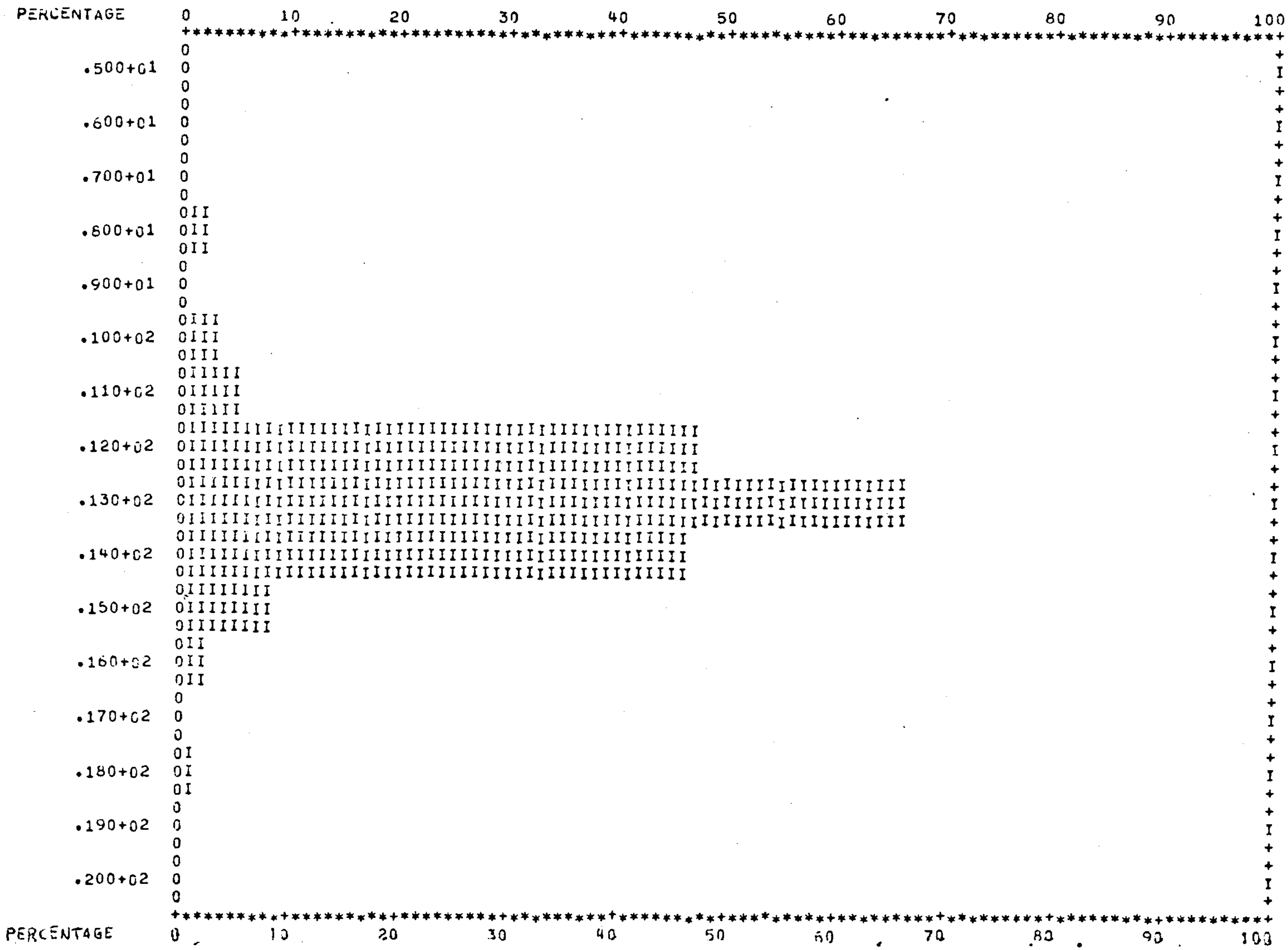

Figure 11. Histogram of educational level.

adult and continuing education programs. Figures 12, 13, 14, and 15 present additional data on the educational levels of various groups.

Although no conclusions can be justified at this point, it is of interest that the younger age group and male subjects were affected significantly by the presession. In this study, there were five subjects having less than eight years of formal education (see Table 14). Of interest is the fact that all five of these subjects were aged 15 or 16 years. Four of the five were male and four of the five attended a presession. In addition, there were four subjects having exactly eight years of education. Two of these subjects were also aged 15 years. The remaining two subjects were over 45 years of age. Of the nine subjects having five through eight years of formal education, six were males and seven were in the youngest age group. If this study could be replicated with more stringent controls on educational level, the results might be different.

Summarizing the results, it is seen that the presession had a significant effect on the subjects in the youngest age group, 15 to 18 years, and on male subjects. There was a significant difference in mean test scores

```
HISTOGRAM ON E WITH B=2
          STEP=      5.00000000
          CENTERPOINT OF INITIAL GROUP=      5.00000000          NO. OF OBSERVATIONS=  120
          CENTERPOINT OF FINAL GROUP=     20.00000000          NO. OF GROUPS=     4
          K FACTOR=     1.
```

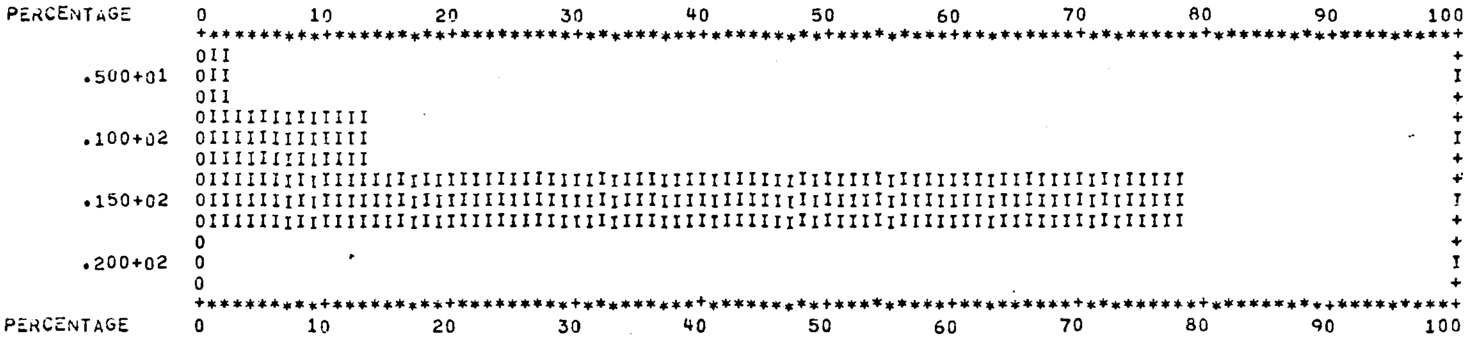

Figure 12. Histogram of educational level for adults attending presession.

```
HISTOGRAM ON E WITH B=1
                    STEP=      5.00000000
                    CENTERPOINT OF INITIAL GROUP=      5.00000000          NO. OF OBSERVATIONS=  120
                    CENTERPOINT OF FINAL GROUP=    20.00000000          NO. OF GROUPS=    4
                    K FACTOR=     2.
```

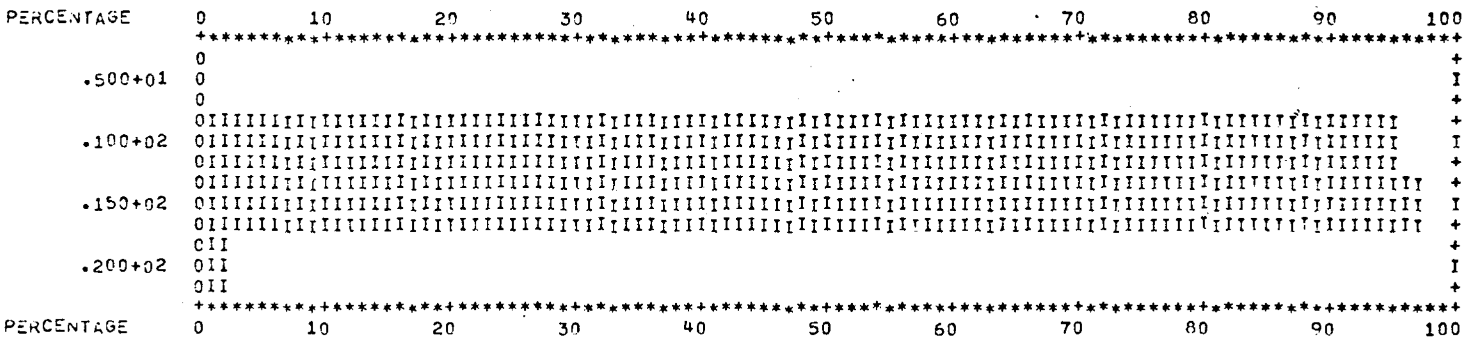

Figure 13. Histogram of educational level for adults not attending presession.

```
HISTOGRAM ON E WITH C=1
                   STEP=      5.00000000
                   CENTERPOINT OF INITIAL GROUP=      5.00000000         NO. OF OBSERVATIONS=  120
                   CENTERPOINT OF FINAL GROUP=    20.00000000          NO. OF GROUPS= .   4
                   K FACTOR=     1.

PERCENTAGE     0         10        20        30        40        50        60        70        80        90        100
               +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
               0                                                                                                    +
     .500+01   0                                                                                                    I
               0                                                                                                    +
               0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                                +
     .100+02   0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                                I
               0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                                                +
               0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                         +
     .150+02   0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                         I
               0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                         +
               0                                                                                                    +
     .200+02   0                                                                                                    I
               0                                                                                                    +
               +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
PERCENTAGE     0         10        20        30        40        50        60        70        80        90        100
```

Figure 14. Histogram of educational level for females.

```
HISTOGRAM ON E WITH C=2
                   STEP=      5.00000000
                   CENTERPOINT OF INITIAL GROUP=      5.00000000          NO. OF OBSERVATIONS=  120
                   CENTERPOINT OF FINAL GROUP=    20.00000000          NO. OF GROUPS=    4
                   K FACTOR=    1.

   PERCENTAGE     0        10        20        30        40        50        60        70        80        90       100
                  +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
                  0II                                                                                                  +
        .500+01   0II                                                                                                  I
                  0II                                                                                                  +
                  0IIIIIIIIIIIIIIIIIIIIIIII                                                                            +
        .100+02   0IIIIIIIIIIIIIIIIIIIIIIII                                                                            I
                  0IIIIIIIIIIIIIIIIIIIIIIII                                                                            +
                  0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                 +
        .150+02   0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                 I
                  0IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII                                 +
                  0                                                                                                    +
        .200+02   0                                                                                                    I
                  0                                                                                                    +
                  +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
   PERCENTAGE     0        10        20        30        40        50        60        70        80        90       100
```

Figure 15. Histogram of educational level for males.

Table 14

Data on Subjects Having Educational Level of Eight or Less Years

Test Score	Presession	Gender	Age[a]	Education[a]
44	no	male	15	5
57	yes	female	15	6
48	yes	male	15	6
57	yes	male	15	7
51	yes	male	16	7
47	no	male	15	8
13	no	male	48	8
56	yes	female	15	8
44	yes	female	60	8

[a]Ages and education levels are in years.

on the Raven Progressive Matrices Test between males and females in the age group 19 to 22 years. There is no clear cut conclusion that can be drawn for the data in this study regarding the effect of age on the performance of adults on a nonverbal test of intelligence. A significant difference in mean test scores was found between the group aged 19 to 22 years and the group aged 30 to 69 years. It appears that if a decline in intellectual ability with age exists, the decline is small and is affected by other factors, such as educational level.

CHAPTER V

DISCUSSION

The results of this study offer support for the proposition that two factors contributing to poor test scores obtained by adults are the lack of orientation to testing procedures and the lack of motivation and/or cooperation (Baltes & Schaie, 1974; Pressey & Kuhlen, 1957). In this investigation, the presession was designed to answer some common questions that adults have about a test taking situation, and to relieve some of the tensions and anxieties that are present when adults are tested. The results of the present study indicate that a presession can assist adults to obtain better scores on the Raven Progressive Matrices Test.

As suggested in the review of the literature, older adults are usually affected by the test taking factors of lack of motivation and lack of orientation because the adults have been out of school and away from testing situations for many years. This investigation yielded some interesting findings. Of the four age groups, only the youngest, 15 to 18 years, showed a significant increase in mean test score on the Raven Progressive Matrices Test from the mean test score of the nonpressesion adults to the mean test score of the presession adults. This age group (60 subjects) also contained a relatively large number (seven) of adults who had eight years or less of formal education. The adults in the youngest age group can hardly be classified as "older" adults. However, the effects of being away from the classroom or any type of testing situation appears to affect the performance of adults whatever their age.

Typically, as noted in the review of the literature, older adults need motivation and orientation to testing procedures in order to perform well in a testing situation. In the present study, the presession did not significantly affect the mean test score in the oldest age group, 30 to 69 years, between those attending a presession and those not attending a presession.

The contents and presentation of the presession should be examined with a view towards revision and a replication of this study. Perhaps more information is needed by the older adults or perhaps a more personal touch in answering questions is needed. As noted in the review of the literature, older adults experience a slowing down in certain tasks. Although there is not enough data from this present study to make inferences about the length of the presession, some speculation is possible. If older adults do need more time to complete tasks on performance tests, would they not also need more time to absorb the material in the presession? In this study, the presession proceeded at a fixed rate of speed. It might be possible that the rate of speed selected is not appropriate for older adults. This speculation is supported by the studies noted in the review of the literature regarding the loss of visual acuity in older adults.

The implications of the use of a presession for educational institutions are present in the results of this study along with studies found in the review of the literature. To increase the efficiency of tests used with adults, a period of orientation could be implemented prior to the testing. With the rapid influx of older students in into higher education and adult education programs, a presession could assist the adults to perform on tests at a level indicative of their true capacity.

As suggested by most cross-sectional studies and some longitudinal studies, and exemplified in the present investigation, a decline in scores on intelligence tests is apparent after the age of 30. Although some studies cite a peak of intellectual ability being reached somewhere earlier than the age of 30, most studies agree that by the age of 30 the decline in performance on intelligence tests is apparent. One limiting factor in the present study is the age grouping. Adults 30 years of age and older were classified in the oldest age group. If a larger sample of older subjects had been available, the age grouping might have separated adults more judiciously such as those in their 30's from those in their 50's. This in turn could have influenced the results of the present investigation.

Another limiting factor in studying the change in intellectual ability with age is the selection of the sample. With few exceptions, the adults in the present investigation were involved in some type of educational activity. A random sample of the adult population might produce entirely different results. However, as noted in the review of the literature, the growth of adult education programs may be producing far reaching results. Adults at the present time and in the future may be well versed in how to take a test. Future studies of the effect of age on test scores utilizing a true random sample may find the educational factor not significant.

In a comparison of the performance of males vs. females on nonverbal tests of intelligence, most studies indicate that males perform significantly better. This is not substantiated in the present investigation on an overall basis. Studying the difference in test performance of males vs. females stratified by age produces a slightly different picture. In the age group 19 years to 22 years, a significant difference in mean test scores of males vs. females is apparent. The question arises as to why this group, 19 to 22 years, demonstrated a male vs. female difference and not the other groups. There must be other factors not accounted for, such as educational level, that are producing the effects in this age group. Another interesting finding is that the presession affected the mean test score of males between those attending a presession and those not attending a presession.

The educational level of the adults being tested can be an important factor in the results obtained. The review of the literature suggests this although the growth of adult education programs may be affecting this factor. The present investigation supports the supposition that older adults may be returning to educational activities. In the present study, older adults appear to have recent educational experiences that in turn may have affected their test performance. A suggestion for a replication of the present study would be to obtain samples adults matched by educational experience.

Perhaps the most important of the findings of the present investigation is that a presession can help to raise the test scores obtained by adults on the Raven Progressive Matrices Test. Further determination of what sections of the presession assisted the adults is needed. Additional studies using other tests and other samples of adults could help to determine the precise items needed for an effective presession.

The present study attempted to control extraneous variables that might enter into the experiment. Bias of the investigator was controlled in the present study by having student aides run the presession and the testing program. The presession was short and the test could be completed in a relatively short time by most adults so that fatigue was apparently not a problem. This fatigue factor is espeically important in testing older adults. The selection of the sample was on a volunteer basis although the inducement of receiving credit for a test in the Individual Mathematics Section Program produced great interest on the part of the students enrolled in this program.

The testing program was conducted in one of the rooms utilized by the Individual Mathematics Section Program. This room is used to run an orientation session for the students in this program and a slide-tape presentation is a common occurance. The testing experiment therefore appeared to most subjects as a routine event. The experiment was conducted over several days for the convenience of the adults, most of whom were attending some type of educational activity at Triton College. When the volunteers signed up for the testing program their summer schedule of classes was noted. A convenient time was assigned so that an extra trip to the college campus was not necessary.

Overall, the experimenter was reasonably confident in the results of the present study. Control of the extraneous variables previously discussed was attempted and no large amount of contamination was apparent.

In conclusion, the present study helps support and replicate the previous findings in the review of the literature. Scores obtained by adults on nonverbal tests of intelligence can possibly be raised by having the adults attend a presession. Older adults apparently score lower on nonverbal tests of intelligence than younger adults. The role of educational activity on the intellectual viability of adults is apparent. The present study did not support the findings that females usually score lower on nonverbal tests of intelligence.

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APPENDIX A

APPENDIX A

SLIDE-TAPE SCRIPT

Slide	Script
Title	The Happy Adventures of a Pencil or How to Take a Test.
1	What are your feelings as you approach a testing situation? Do you feel like you are starting a Happy Adventure? Do you feel petrified? Are you somewhere inbetween these two extremes? Many people have great difficulties when they take a test, so you are not alone. Are there some things you can do to improve your test taking techniques? The answer is yes, yes, yes.
2	If htis is your reaction to a test, you will be thinking, "A test is a frightening experience." It doesn't have to be. We will pose some questions and offer some possible solutions. In this way, we may be able to help you help yourself. The questions are not necessarily in order of importance. Let's just take them one at a time, and try to resolve them.
3	One purpose of testing is to determine how much knowledge or information a person possesses. This is the area of the classroom test or the general information test. If you are taking a course, you certainly want to do your best. If you are taking a general intelligence test or the ACT test, you would like to obtain the best possible score. There are also programs such as CLEP or GED, in which the testing may result in college credit or a certificate
4	A test can be used for placement in a course, in a program, or in a job. For example, here at Triton College, placement tests in reading and mathematics are given to new students. The results of these tests will help determine the best level or course for you. Some of you are probably saying," I'll never take a mathematics course." Hundreds of

students have said the same thing, only to realize in a few weeks or months that they do have to take math in their chosen program.

5 Let's find some ways to help you. When is the best time to ask a question about the test, about the procedures, or about anything connected with the testing situation? The answer is: Before the test begins. Once a test begins, questions are usually not allowed. If you are not sure of something, don't be afraid, ask.

6 Even such simple questions as these, can be and will be quickly answered by any of the persons in charge of the test. They are happy to give you as much assistance as they can before teh test begins. The directions for a test are given before you start the test. Sometimes the directions will be read aloud by the person in charge or sometimes you will be told to read them yourself. In either case, if you don't understand something, ask.

7 The directions for a test are given for specific reasons. For example, if the directions say, "Answer each questions in order, and do not skip any questions.", your score on the test could be changed for better or worse, if you skip some questions, probably for the worse, depending on how the test is scored.

8 If the test calls for you to use a pencil and you don't, your test will probably be a disaster. The reason that pencil is required is that meny tests are machine scores and the machines ignore ink or ballpoint. Since the machine ignores ink, you might receive a zero for a score.

9 To guess or not to guess, that is the question. There is no set answer. Everything depends on how the test will be scored. Some tests simply record the number of correct answer you have. Others penalize you for wrong answers. Still others penalize you for both wrong and skipped answers. If the directions don't tell you about guessing, ask how the test will be score.

10 If there is no penalty for guessing, by all means, guess. If you are penalized for wrong answer but not for skipped ones, guess if you are fairly sure of the answer. If the question is completely strange, don't answer it. If you are penalized for both wrong and skipped answers, proceed cautiously, carefully, and guess when necessary. Related to all of this is the pressure of time, if there is a time limit for taking the test. Make sure you know the time limit and try to pace yourself.

11 Look carefully at the answer sheet and be sure you know where the answers go. Some answer sheets have the answers going down the page, others go from left to right. If you insert the answer in a space, be sure to put it in the correct space. For multiple choice tests, see whether you circle the correct answer, insert a letter or number, or make a mark in a little box. This is especially important if the test is to be machine score. If the test has more than one section or part, be sure to put section one answers in section one on the answer sheet.

12 One of the biggest factors in taking a test is tension. If you are tense, you cannot do your best work. "Try to relax". That's the easiest thing to say and the hardest thing to do. Here are some little tricks that might help. Bring some hard candy with you and chomp on it during the test. Some people prefer to chew gum. In either case, keep your jaws moving. For many people, this helps to relieve tension. During a long test, every ten or fifteen minutes, close your eyes and take a few deep breaths, wiggle your toes, shift your position in the chair. Don't stay in any position for too long a time. No one can work well with a stiff neck. Change the position of the pencil in your hand. Tension can make your hand sore after only a few minutes.

13 Hopefully, these suggestions will help change your attitude towards tests of all types. Instead of

"Welcome to the frightening experience of a test", you will be saying to yourself, "Welcome to the wonderful world of a challenge."

APPROVAL SHEET

The dissertation submitted by Carole Ann Bauer has been read and approved by the following committee:

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

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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