# Education, Task Meaningfulness, and Cognitive Performance in Young-Old and Old-Old Adults*

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*Paper originally presented at the 32nd annual meeting of the Gerontological Society, Washington, D.C., November 1979. Preparation of this paper was facilitated by research Grant 5 P01 AG00133 from the National Institute on Aging to the third author.

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Running head: Education and Task Meaningfulness

Abstract

Previous research has indicated that when tasks are made more meaningful, the performance of the elderly generally improves. A closer look, however, reveals that improvement occurs mostly for educationally disadvantaged elderly, highly educated older adults not benefiting differentially from meaningful material. Consequently, the present study compared performance of high and low education adults on traditional and meaningful space and reasoning measures. A total of 246 male and female volunteers were divided into subgroups by age (53-65 and 70-78 years) and by education (high and low). Separate analyses of variance for reasoning and space revealed main effects for education and age on both abilities. In addition, main effects for test and sex, and a significant age by test interaction were found for space, with the performance differential between the familiar and traditional tests being much greater for the young-old group. A trend for an education x age x test x sex interaction was found for reasoning, as expected, with low education, young-old men doing more poorly on the traditional form. Suggestions for future related research are discussed.

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One problem which has plagued researchers in the area of adult intellectual development has been the inappropriateness of existing measures of intelligence for the elderly. Current theory and research suggest that traditional intelligence tests are both unfamiliar and irrelevant for the majority of older adults.

Indeed, previous research has indicated that when tasks are made more meaningful the performance of the elderly generally improves (Arenberg, 1968; Gardner & Monge, 1977; Hulicka, 1967; Sinnott, 1975). A variety of different techniques have been employed to increase task meaningfulness, and improvement has been noted on several different types of abilities, although this is not without exception.

In theory, it has been reasoned that traditional intelligence tests, that were originally intended as predictors of academic performance in young adults, are invalid indices when used to predict everyday competence in older individuals. For example, younger individuals have had more experience with traditional tests and consequently, traditional tests are more meaningful to younger cohorts in terms of familiarity. The abstract materials which comprise most ability tests are quite familiar to many young adults in that their recent school experience has exposed them to regular ability and aptitude testing. In contrast, the elderly are experientially disadvantaged both by being further removed from formal educational experience as well as the fact that even when they were in school the use of tests was not as widely employed as it has been in more recent decades. In this sense, then,

traditional tests might be quite familiar and more meaningful to younger cohorts but relatively novel, and hence, less meaningful, to older adults.

Not only are conventional tests less meaningful to older cohorts in terms of familiarity but conventional tests are also less meaningful in terms of relevancy to everyday life. In other words, poor performance of older cohorts on traditional tests may occur because tests which are viewed as irrelevant may fail to evoke the necessary level of involvement or motivation needed for optimal performance. For instance, younger cohorts, having been brought up in the test-taking culture, may be more sympathetic to both the individual and the societal benefits of testing. Older cohorts, on the other hand, may be culturally alienated to the concept of testing and thus less likely to see reasons for cooperating and becoming sufficiently involved with the task to perform optimally.

As can be seen from these preceding examples, meaningfulness can be conceptualized in several different ways. For the present study, we have chosen to conceptualize meaningfulness in terms of familiarity.

To further exacerbate matters, other effects associated with prior educational experience, perhaps of a more profound nature, have been found to be related to performance. Specifically, level of education attained has been found to play a role in intelligence test performance (Birren & Morrison, 1961). Thus, it is possible that performance differences between young and old cohorts are not necessarily attributed to age alone, but rather may be attributed in part to differences in level of education attained.

Moreover, studies which have examined education in relationship to intellectual performance within older cohorts have found that more highly educated older people generally perform better than their lesser educated peers (Welford, 1958).

Unfortunately, in spite of these findings, many studies which have examined cognitive performance in older people have been designed so that all old people are grouped together. This type of design operates under the assumption that age is the only important distinguishing variable in performance, and fails to take into account the effects of other important variables, such as, education. However, a closer look at certain studies suggests that taking such variables into account would be a good idea. For example, age differences in preference for concrete versus abstract solutions were found to be less pronounced (Welford, 1958) or nonexistent (Cijfer, 1966) in highly educated older individuals. Taken together, these studies suggest that education may reduce age differences in performance and response repertoires.

Based on implications from these studies, the purpose of the present research was to examine the effects of education on performance on abstract- and familiar-stimuli tests in older adults. It was predicted that highly educated older people would perform more like their younger peers and not be as susceptible to meaningfulness manipulations as their lesser educated, old peers.

## Method

The subjects were a subset of a larger sample which was recruited from the membership of a southern Californian health maintenance organization. The subset was selected on the basis of age, since the larger sample is comprised of individuals ranging in age from 30 to 92. The young-old and old-old age groups were selected for investigation since previous research (Quayhagen, Gonda, & Schaie, Note 1) has suggested that individuals over 70 years old are often affected by age changes rather than just experiential/situational factors, and therefore are unable to benefit from the more familiar forms.

A total of 246 men and women were used for the present analysis. Two age levels were examined: young-old (53 to 65 years old) and old-old (70 to 78 years old). Subjects were also divided into two educational levels: low (12 years of education or less) and high (13 years of education or more). Subjects were about equally distributed by sex, age level, and education level.

Procedure

One half of the subjects were given the traditional forms of both space and reasoning tests and the other half were given newly developed, familiar-stimuli versions of the same tests. The difference between test forms was the use of familiar stimuli in place of abstract stimuli. However, we attempted to keep the difficulty level of the two forms for each test the same. Altogether, four paper-and-pencil tests were used. Tests consisted of two Adult Mental Abilities (AMA) subtests for space and reasoning (adapted versions of the Primary Mental Abilities tests (PMA) (Thurstone & Thurstone, 1948)), namely the Figure Rotation test (the spatial test) and the Letter Series test (the reasoning test). In addition to these conventional tests, two newly constructed, presumably more ecologically valid space and reasoning analogs were also administered. For space, the Object Rotation Test (ORT) (Quayhagen, Note 2) was used and for reasoning the Word Series test (Gonda, Note 3) was administered.

The Object Rotation test was constructed as an alternative and presumably more meaningful form of the PMA Space test. Line drawn familiar object rather than abstract figures are used as stimuli. Objects were selected for inclusion in the test if they were frequently named, meaningful and easily identifiable household objects. The 20-item ORT was constructed so that the rotated matched or reflected comparison of the objects in each row correspond to the rotated figures of the traditional PMA Space test.

For the Word Series test, the months of the year and days of the week were chosen as verbal stimuli. These words represent familiar, overlearned, verbal relationships which have smaller range than the 26-letter alphabet, and therefore were assumed to be easier to conceptually manipulate. The repetition pattern for each item of the traditional reasoning test was maintained in the new Word Series test.

## Results

A separate 2 (education) x 2 (age level) x 2 (test) x 2 (sex) analysis of variance was conducted for reasoning and space.

For space, significant main effects obtained for education ($F = 9.3$, 1, 230, $p < .01$), age ($F = 18.1$, 1, 230, $p < .001$), test ($F = 19.1$, 1, 230, $p < .001$) and sex ($F = 10.9$, 1, 230, $p < .001$). More specifically, high education subjects

Insert Table 1 about here

outperformed low education subjects, young-old individuals outperformed old-old individuals, subjects receiving the familiar form scored higher than those receiving the traditional form, and men scored higher than women.

In addition an age by test interaction was found, with the performance differential between the familiar and traditional tests being much greater for the young-old group.

For reasoning, slightly different effects obtained. Again, main effects obtained for education ($F = 31.0$, 1, 229, $p < .001$), and age ($F = 31.9$, 229,

Insert Table 2 about here

$p < .001$) with the same pattern as that found for space, that is, high education subjects performed better, as did the young-old. And again, main effects for sex were found ($F = 3.97$, 1,229, $p < .05$), but in contrast to space, in favor of women for reasoning. No test effects nor age x test interactions were found as were for the spatial tests. However, a trend ($p < .07$) for an

age x test x sex interaction was found, with young-old men doing more poorly on the traditional reasoning task. There was also a trend, ($p<.06$) as had been expected, for an education x age x test x sex interaction, again with low education, young-old men doing more poorly on the traditional form.

Insert Table 3 about here

## Discussion

The present results are provocative for several reasons. First, while there was only a trend for the expected age x education x test x sex interaction, it was in the same direction as had been expected. Consequently, we are encouraged to further investigate the role of education and task meaningfulness on performance, particularly in light of the fact that the present study was quite a conservative test of the education/task meaningfulness relationship. For example, different education levels were only grossly distinguished, merely on the basis of whether or not the individual had any post-secondary education.

Possibly, if we had formed extreme or more distinctive groups, for example, high school graduates versus college graduates, we would have increased the likelihood of obtaining stronger effects. In fact one of the problems with the studies which have looked at the effects of education on performance is that high and low education are usually operationalized differently in every study and thus make generalization difficult.

Another constraint is that our efforts at designing meaningful tests have been general in scope, in the sense that we have not aimed our familiar tests at any particular subgroup of elderly in terms of demographic characteristics such as education. The fact that education may be a variable involved in the dynamics of meaningfulness effects on performance stimulates our thinking to discover what other variables may be involved. Perhaps we

should be more specific in our efforts and begin to pinpoint certain subgroups of elderly and go from there, that is, try to find out not only what stimuli are meaningful to a particular subgroup but also what abilties are relevant to the everyday functioning of a particular subgroup. In fact, our work is beginning to develop along these lines.

Perhaps, as others have suggested (Scheidt, Note 4) we should take the opposite tact of the one we've been using, that of constructing analogs for traditional tests, and rather, start with a meaningful task or behavior and then develop tests of ability that fit into the context of where that particular behavior occurs. For instance, Capon & Kuhn (1979) have attempted to assess reasoning in an actual naturalistic setting in which it might be expected to occur, namely, a supermarket. They conceptualized reasoning as the ability to determine the best supermarket buy when size and price of product were manipulated.

Lastly, one thing that seems apparent from our research on meaningfulness and education, is that current tests, whether they are conventional tests or ones which attempt to be more age-appropriate for the elderly. may very well become obselete for future cohorts of elderly. On the other hand, it is entirely possible that given the changing composition of future old cohorts, especially in terms of education, present day conventional tests may be quite appropriate for measuring competence in these more highly educated, elderly cohorts of the future.

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Table 1

Means and Standard Deviations for Education

on Spatial Tests *

| Education | |
|---|---|
| Low | High |
| 16.79 | 19.53 |
| (11.19)** | (10.13) |

* Total possible score = 54

** Standard Deviations are beneath means

Table 2

Means and Standard Deviations for

Education on Reasoning Tests*

| Education | |
|---|---|
| Low | High |
| 8.55 | 11.54 |
| (5.19)** | (4.82) |

*Total possible score = 30

**Standard Deviations are beneath means

Table 3

Means and Standard Deviations for
Education by Age by Test by Sex
Interaction on Reasoning Tests*

| | Education | |
|---|---|---|
| Group | Low | High |
| **Letter Series** | | |
| Old-Old | | |
| Men | 7.21 (4.93)** | 8.43 (4.89) |
| Women | 7.22 (6.00) | 10.43 (4.85) |
| Young-Old | | |
| Men | 5.78 (2.99) | 12.29 (4.92) |
| Women | 12.23 (5.76) | 13.20 (5.27) |
| **Word Series** | | |
| Old-Old | | |
| Men | 6.11 (3.97) | 8.61 (4.82) |
| Women | 8.04 (5.33) | 9.64 (4.08) |
| Young-Old | | |
| Men | 11.57 (5.06) | 14.56 (5.24) |
| Women | 10.23 (7.49) | 15.16 (4.51) |

*Total possible score = 30

**Standard Deviations are in parentheses next to means