
EDUCATION, TASK MEANINGFULNESS,
AND COGNITIVE PERFORMANCE
IN YOUNG-OLD AND OLD-OLD ADULTS

Judith Gonda
Margaret Quayhagen
K. Warner Schaie
University of Southern California

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 \times age \times test \times 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.

One problem that 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.

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

In theory it has been reasoned that traditional intelligence tests, which 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 that 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 the fact that they are further removed from formal educational experience and by 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 they are also less meaningful in terms of relevance to everyday life. In other words poor performance of older cohorts on traditional tests may occur because tests that 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 by 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 exacerbate matters further, 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 that have examined education in relationship to intellectual performance within older cohorts have found that more highly educated older people generally perform better than their less educated peers (Welford, 1958).

Unfortunately, in spite of these findings, many studies that 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 it fails to take into account the effects of other important variables, such as education. A closer look at certain studies, however, 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 less-educated old peers.

METHOD

The subjects were a subset of a larger sample recruited from the membership of a southern California health maintenance organization. The subset was selected on the basis of age, because the larger sample comprised individuals ranging in age from 30 to 92. The young-old and old-old age groups were selected for investigation because previous research (Quayhagen, Gonda, & Schaie, Note 1) has suggested that individuals older than 70 are often affected by age changes rather than just experiential or situational factors and are therefore unable to benefit from the more familiar forms. A total of 246 men and women were selected for the present analysis. Two age levels were examined: the young-old (53-65 years old) and the old-old (70-78 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. We attempted to keep the difficulty level of the two forms for each test the same, however. 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 World 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 objects 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 that have a smaller range than the 26-letter alphabet and therefore were assumed to be easier to manipulate conceptually. The repetition pattern for each item of the traditional reasoning test was maintained in the new Word Series Test.

RESULTS

A separate 2 (education) \times 2 (age level) \times 2 (test) \times 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 ($F = 10.9, 1, 230, p < .001$) (see Table 1). More specifically, high-education subjects 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 \times 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

TABLE 1 Means and Standard Deviations for Education on Spatial Tests and Reasoning Tests

Spatial tests ^a	
Low education	High education
16.79 (11.19)	19.53 (10.13)
Reasoning tests ^b	
8.55 (5.19)	11.54 (4.82)

Note. Standard deviations are in parentheses.

^aMaximum possible score is 54.

^bMaximum possible score is 30.

($F = 31.9, 1, 229, p < .001$) with the same pattern as that found for space, that is, high-education subjects performed better, as did the young-old (see Table 1). 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 \times test interactions were found for the spatial tests. However, a trend ($p < .07$) for an age \times test \times sex interaction was found, with young-old men doing more poorly on the traditional reasoning task. There was also a trend, as can be seen in Table 2, ($p < .06$), as had been expected, for an education \times age \times test \times sex interaction, again with low-education, young-old men doing more poorly on the traditional form.

DISCUSSION

The present results are provocative for several reasons. First, while there was a trend only for the expected age \times education \times test \times sex interaction, it was in the same direction as had been expected. Consequently we are encouraged to investigate further 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 the individual had any postsecondary 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 that have looked at the effects

TABLE 2 Means and Standard Deviations for Education \times Age \times Test \times Sex Interaction on Reasoning Tests

Group	Low education		High education	
	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)	

Note. Total possible score is 30. Standard deviations are in parentheses next to means.

of education on performance is that high and low education are usually operationalized differently in every study, and generalization is thus made 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 abilities 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 tack of the one we have been using, constructing analogs for traditional tests and start with a meaningful task or behavior and then develop tests of ability that fit the context of where that particular behavior occurs. For instance, Capon and 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.

Finally, one thing that seems apparent from our research on meaningfulness and education is that current tests, whether they are conventional tests or ones that attempt to be more age-appropriate for the elderly, may very well become obsolete 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.

REFERENCE NOTES

1. Quayhagen, M., Gonda, J., & Schaie, K.W. Are familiar tasks always meaningful? In D. Kramer & M. Lachman, *From lab to life: Suggestions for implementing ecologically valid research across the life-span*. Symposium presented at the annual meeting of the Gerontological Society, Washington, D.C., November 1979.
2. Quayhagen, M. Test/situational factors in spatial task performance. In K.W. Schaie, *Ecologically valid assessment of intellectual functioning in the elderly*. Symposium presented at the Western Psychological Association meeting, San Francisco, April 1978.
3. Gonda, J. The word series test. Unpublished test, University of Southern California, 1978.
4. Scheidt, R. Discussant comments. In D. Kramer & M. Lachman, *From lab to life: Suggestions for implementing ecologically valid research across the life-span*. Symposium presented at the annual meeting of the Gerontological Society, Washington, D.C., November 1979.

REFERENCES

- Arenberg, D. Concept problem solving in young and old adults. *Journal of Gerontology*, 1968, 23, 279-282.
- Birren, J.E. & Morrison, D.F. Analysis of the WAIS subtests in relation to age and education. *Journal of Gerontology*, 1961, 16, 363-369.
- Capon, N., & Kuhn, D. Logical reasoning in the supermarket: Adult females' use of a proportional reasoning strategy in an everyday context. *Developmental Psychology*, 1979, 15, 450-452.
- Cijfer, E. An experiment on some differences in logical thinking between Dutch medical people, under and over age 35. *Acta Psychologica*, 1966, 25, 159-171.
- Gardner, E.F., & Monge, R.H. Adult age differences in cognitive abilities and educational background. *Experimental Aging Research*, 1977, 3, 337-384.

- Hulicka, I.M. Age differences in retention as a function of interference. *Journal of Gerontology*, 1967, 22, 180-184.
- Sinnott, J.D. Everyday thinking and Piagetian operativity in adults. *Human Development*, 1975, 18, 430-443.
- Thurstone, L.L., & Thurstone, T.G. *SRA primary mental abilities*. Chicago: Science Research Associate, 1948.
- Welford, A.T. *Aging and human skill*. London: Oxford University Press, 1958.

Received March 9, 1980

Accepted April 1, 1980

Request reprints from Judith Gonda, Andrus Gerontology Center, University of Southern California, University Park, Los Angeles, CA 90007.