1978

Five Novel Tasks for the Assessment of Cognitive Abilities in Older Adults

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XI th Int. Congress of Gerontology
Tokyo, Japan, 1978

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A recurring complaint of much cognitive research in the field of aging has been that the measures used are not appropriate for use with an elderly population. After a brief introduction we will present several problem-solving tasks designed for use with the elderly. Along with each of the tasks we will discuss two sets of regression data, the first of which will relate performance on each of the tasks to age, education and other life experience information. The second set will relate performance on the new tasks to performance on standard tasks of intellectual functioning as well as the life experience factors.

To assess problem-solving ability in the elderly with minimal test and situation bias, several test criteria should be met. Among these criteria are the following. Tests should be designed with use for the elderly in mind, not simply lifted from the population for which they were designed and then applied to elderly groups; norms should be developed for the elderly and not extrapolated from norms for younger populations; materials should be familiar and not intimidating; the concepts the instruments were designed to measure should be presented in a way that does not create barriers for the elderly; answer sheets should be kept to a minimum; writing should be kept to a minimum; time limits should be dropped when practicable; and materials should be easy to read and to handle.

With these criteria in mind, we designed several problem-solving tasks using playing cards as materials. Since playing cards are so universally used in the United States, we anticipated that the materials and problems would be non threatening and even motivating to individuals with no prior testing experiences and yet sufficiently intriguing to interest those individuals who are accustomed to testing situations. Several of the tasks reflect Piagetian concepts and all of the tasks were designed to tap abilities required for adequate cognitive functioning in adults.

Subjects and Method

Fifty-eight individuals ranging in age from 30 to 79 were selected from those volunteering for additional testing following the data collection for the longitudinal study carried out by Warner Schaie and his colleagues in the Seattle area. Seven men and seven women from each 10-year age group between 40 and 87 and three women in their 30's were tested. Only six men in the 50-59 age group were tested. The mean number of years of education was 13.5 with a standard deviation of 3.0. There was a negative correlation of .12 between age and number of years of education. The volunteers were paid for their participation and were tested individually in one-to one-and-one-half hour sessions.

Task Description and Findings

As part of their participation in the longitudinal study, participants were administered the Primary Mental Abilities Test (Thurstone, 1949), the Test of Behavioral Rigidity (Schaie, 1960) and several tests of the Test Reference Kit (Educational Testing Service, 1963).

The first card tasks, free and serial classification, are based on a Piagetian model and follow work reported by Denney and her colleagues (Denney, 1974a, 1974b) and by Kogan (1973, 1974). The task is to group 32 playing cards to four shapes (standard, round, oversized and zigzag), all four suits and two numerical values into as many categories as one wishes. Such grouping continues until the individual can think of no more ways to sort the cards. The first sorting was analyzed as a free classification task. In that sorting, the number of attributes of the cards used for sorting the cards (e.g. suit, shape or number) was predicted in a multiple-regression analysis only by card playing history and sex (see Table 1). The number of variables across all the consecutive sortings was predicted by education, age, card playing and sex. This measure of productivity appears to correspond to Guilford's (1967) "spontaneous flexibility" criterion. Predicting the number of consecutive classifications (Guilford's "fluency") was age alone. As can be seen in Table 2 in which various tests of the larger battery were entered into the prediction equation, the PMA Reasoning Test, a number series test contributed substantially to the variance accounted for in the number of variables or attributes used to classify the cards but not into the number of consecutive sortings.

For the multiple classification task participants are presented with a matrix of three cards and asked to choose one of five alternatives to complete the matrix (Storck, Looft & Hooper, 1975). To solve the 12 problems correctly the individual needs to determine the relationship among the original three cards and then to choose a final card that is related to those three. Age, education, and to a lesser extent, card playing predicted the number of correct responses as seen in Table 1. However, when the number correct on the PMA Reasoning Test was added to the equation, that alone accounted for a substantial proportion of the variance with sex and card playing contributing only slightly. It is interesting to note that although performance on the PMA Reasoning Test correlates .78 with performance on the multiple classification task, age correlates more highly with the PMA task (.66) than with the multiple classification task (.49). That discrepancy could indicate that ability differences account for more of the variance in the multiple classification task than in the PMA Reasoning Task although the difference may also be due to error.

The <u>spatial rotation task</u> requires the respondents to imagine rotating a fixed matrix of nine cards to a predetermined series of positions and to reproduce the rotated matrix with a duplicate set of cards. Age, card playing, education and sex all contributed to the prediction of the number of problems correctly solved, although age was the primary factor. When performance on the PMA Spatial Rotation Test and on the ETS Hidden Patterns Test was added to the prediction equation, Hidden Pattern performance was predictive of performance on the card task while the PMA Spatial performance was not. It may be that very different processes are involved in the PMA Spatial Rotation test and the card spatial test. Since the subjects were asked how they had solved the card rotation problems it was possible to analyze the relative effectiveness of the problem-solving style. Those who mentally rotated the matrix as instructed and those who instead imagined themselves on the other side of the matrix had an advantage over those who tried to use a verbal, non-spatial process and those who had no idea at all how they had tried to solve the problem.

In the next task, memory for a spatial display, participants are shown a fixed display and after examining it carefully for as long as they like, are asked to reproduce the display with a duplicate set of cards. Age, sex, and to a lesser extent, card playing predicted the number of cards correctly placed. But when performance on the PMA space and reasoning tasks were added to the equation, the spatial measure was the primary prediction. Clearly, more than a simple memory task is involved here. Analyses are underway to determine the relative effectiveness of the various strategies used in solving this problem.

In the final task, cognitive flexibility, the respondents are asked to learn a simple strategy for determining whether two cards are the "same" or "different". After a practice trial, an irrelevant variable is introduced for the second trial. On the third and final trial, the previously irrelevant variable is to be used in the same different determinations while one of the previous critical variables becomes irrelevant. Although several scoring schemes were tried, the most useful has been simply the number of errors on the third trial. This is predicted by age, sex, card playing and education. The amount of time required for that final trial is predicted by the same variables but in a different order (see Table 1). In the second analysis (Table 2) the perceptual speed factor of the Test of Behavioral Rigidity proved to be the primary predictor of both time and errors with motor-cognitive rigidity adding to the explained variance of error scores.

Conclusions

The tasks have now been administered in five studies to 218 individuals ranging in age from 18 to 83. The initial two administrations, one in Los Angeles and one in a retirement community in New Jersey, served to test the materials for acceptability to elderly individuals and provided information on problem solving strategies and competence in the two populations. The third study (Krauss & Quayhagen, 1977) was concerned primarily with several tests of spatial abilities but provided reliability data on the card tasks since they were administered twice in a two-week period. The fourth use of the tasks (Krauss & Tom, 1977) provided the first set of data on a younger group. The most recent study was discussed today.

In the initial studies involving these card tasks (Reference notes 1, 2, 3) education appeared to account for more of the performance than did age. In those studies, however, the age range was not as great as in the current study. Analysis designed to determine if the results of the different studies would have been comparable had the age groups been identical indicated that age range did not explain the differential findings. Education levels for the different studies were also different, however, with a mean number of years of education for the Seattle group of 13.5 years (SD = 3.0) and for the Los Angeles group of 12.2 years (SD = 3.7). Those differences in educational level may explain the differences in findings.

In conclusion, these tasks appear to be of benefit in assessing competence in adult and elderly populations in that they have been generally acceptable to the groups with whom they have been used, they meet the criteria for tests for the elderly outlined earlier, and they appear to distinguish among individuals according to ability levels apart from the influence of age, education and other life experience factors.

Reference Notes

1. Krauss, I. K. Predictors of competence in the elderly. Paper presented at the annual meeting of the Western Psychological Association, Los Angeles, 1976.

2. Krauss, I. K. Age, education and classification skills. Paper presented at the 57th Annual Meeting of the Western Psychological Association, Seattle, April 1977.

3. Krauss, I. K., & Schaie, K. W. Errors in spatial rotation in the elderly. Paper presented at the annual meeting of the American Psychological Society, Washington, D.C., September 1976.

References

Denney, N. W. Classification abilities in the elderly. _Journal of Gerontology_, 1974, _29_, 309-314, (a).

Denney, N. W. Evidence for developmental changes in categorization. _Human Development_, 1974, _17_, 41-53, (c).

Kogan, N. Creativity and cognitive style. In P. Baltes & K. W. Schaie (Eds.), _Life-span developmental psychology_. New York: Academic Press, 1973.

Kogan, N. Categorizing and conceptualizing styles in younger and older adults. _Human Development_, 1974, _17_, 218-230.

Schaie, K. W. _Examiner manual for the Test of Behavioral Rigidity_. Palo Alto, Calif.: Consulting Psychologists Press, 1960.

Schaie, K. W., Labouvie, G. V., & Buech, B. U. Generational and cohort-specific differences in adult cognitive functioning: A fourteen-year study of independent samples. _Developmental Psychology_, 1973, _9_(2), 151-166.

Thurstone, L. L., & Thurstone, T. G. _SRA Primary Mental Abilities Test_. Chicago: Science Research Associates, 1949.

Table 1: Step-Wise Multiple-Regression Analysis of Card Task Performance, Age, Education, Card Playing and Sex.

Task	Predictor 1 (or 5)	R	Predictor 2 (or 6)	R	Predictor 3	R	Predictor 4	R	Total R	Total Variance Accounted for
Free Classification: Number of Variables	Card Playing	.28*							.28*	.08
Serial Classification: Number of Variables	PMA Reasoning	.39**	Education	.46**	Card Playing	.47**			.47*	.22
Number of Classifications	Age	.27*							.27*	.07
Multiple Classification: Number Right	PMA Reasoning	.78***	Sex	.79***	Card Playing	.79***			.79***	.63
Space Number Right	Hidden Patterns I	.59***	Age	.64***	Hidden Patterns II	.66***	Card Playing	.68***	.68***	.46
Memory Number of Cards Correctoy Placed	PMA Space	.35**	Age	.41**	PMA Reasoning	.46**	Sex	.49**	.53**	.28
	(5) Playing Cards	.51**	(6) Multiple Classification	.52**						
Flexibility Errors	TBR Perceptual Speed	.46***	TBR Motor-Cognitive Rigidity	.49***	Education	.50***	Age	.51**	.51**	.26
Time	TBR Perceptual Speed	.48***	Age	.51***	Sex	.53***			.54**	.29

*$p < .05$
**$p < .01$
***$p < .001$

Table 2: Step-Wise Multiple-Regression Analysis of Card Task Performance With Age, Education, Sex, Card Playing, and Other Tests of Abilities.

Task	Predictor 1	R	Predictor 2	R	Predictor 3	R	Predictor 4	R	Total R	Total Variance Accounted for
Free Classification:										
Number of Variables	Card Playing	.28*	Sex	.33*					.33*	.10
Serial Classification:										
Number of Variables	Education	.36**	Age	.42**	Card Playing	.44*	Sex	.44*	.44*	.20
Number of Classifications	Age	.27*							.27*	.07
Multiple Classification:										
Number Right	Age	.49***	Education	.56***	Card Playing	.56***			.56***	.31
Space										
Number Right	Age	.51***	Card Playing	.54***	Education	.56***	Sex	.56	.56***	.32
Memory										
Number of Cards Correctly Placed	Age	.33*	Sex	.39*	Card Playing	.39*			.39*	.16
Fexibility										
Errors	Age	.34*	Sex	.40**	Card Playing	.41*	Education	.42*	.42*	.18
Time	Age	.38**	Education	.43**	Card Playing	.43*	Sex	.43*	.43*	.19

*$p < .05$
**$p < .01$
***$p < .001$