



Real-world problem solving and quality of life in older people

M. L. Gilhooly¹, K. J. Gilhooly^{2*}, L. H. Phillips³, D. Harvey⁴,
A. Brady⁵ and P. Hanlon⁶

¹Brunel University, UK

²University of Hertfordshire, UK

³University of Aberdeen, UK

⁴MRC Social and Public Health Services Unit, Glasgow, UK

⁵Strathclyde Regional Council, UK

⁶University of Glasgow, UK

Objectives. This study examined relationships between quality of life (QoL) in older people and cognitive functioning in both abstract and real-world problem solving.

Design. Contributions of levels of mental, physical and social activities, self-rated and objective health status, self-rated cognitive functioning, socio-economic status, gender, real-world and abstract problem solving were examined in a regression study of factors related to QoL in older people.

Method. Participants ($N = 145$) were 70–91 years of age. The current cognitive functioning was assessed by psychometric tests and real-world problem-solving tasks. Prior functioning was indexed by crystallized ability measures. QoL was assessed using the Leiden-Padua questionnaire (LEIPAD), Faces scales and Hospital and Anxiety Depression Scale. A single QoL factor was derived.

Results. Simultaneous multiple regressions indicated that QoL was related to real-world but not to abstract problem-solving ability. Separate contributions to QoL were also found for health and self-rated cognitive functioning.

Conclusions. The present study replicates previous findings that abstract problem-solving ability is not related to QoL and supports the hypothesis that real-world or everyday problem-solving ability is associated with QoL in older people.

This paper addresses the relationships between quality of life (QoL) in older people and cognitive functioning. Many issues of meaning and methodology arise in measuring QoL (see, Gilhooly, Gilhooly, & Bowling, 2005). A generally useful definition is given by

*Correspondence should be addressed to K. J. Gilhooly, School of Psychology, University of Hertfordshire, Hatfield Herts AL10 9AB, UK (e-mail: k.j.gilhooly@herts.ac.uk).

the World Health Organization Quality of Life Group (1993) in which QoL is seen as including:

‘... the individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations and standards and concerns. It is a broad ranging concept affected in a complex way by the person’s physical health, psychological state, level of independence, social relationships and their relationships to salient features of their environment.’

Despite the well-documented decline in fluid cognitive ability with age (e.g. Schaie, 1994), which might be expected to reduce reported QoL, age itself does not seem to be associated with declining QoL (Argyle, 1999). Furthermore, absolute levels of functioning and extent of decline over the life-span do not appear to be linked to QoL. In a recent study of 416 older people aged about 79 years, Gow *et al.* (2005) reported that cognitive ability assessed at the age of 11 years and that assessed at the age of 79 years (using the same Moray House Test on both occasions), as well as changes in cognitive ability over a lifetime, did not predict satisfaction with life in old age (as indicated by the 5-item Life Satisfaction Scale developed by Deiner, Emmons, Larsen, & Griffin, 1985). Other studies have also found that current cognitive ability does not appear to be significantly related to life satisfaction or reported QoL when other factors such as educational level are taken into account (Argyle, 1999; Diener, 1984). However, it may be that the reported lack of a relationship between cognitive functioning and QoL has been because cognitive ability in previous studies has been measured using tests of performance on abstract problems, rather than problems more representative of real-world tasks. The ability to solve real-world tasks is generally tapped by means of paper-and-pencil scenarios representing common types of problems that individuals may encounter in their own lives. Respondents generate possible solutions which are then assessed for quality by independent judges (see Berg & Klaszynsky, 1996). Although ability to solve abstract puzzles of the type found in standard intelligence tests is related to success in real-world occupational and educational settings as indicated by validity studies (Deary, 2001), it may be that older people’s self-judged QoL is more related to how well they reach their own goals in daily life which depends on solving real-world problems rather than abstract puzzles. Abstract problems, as found in psychometric tests of general problem-solving ability, are designed so that prior knowledge is not relevant, the problems are well defined, generally have but one correct answer and lack socio-emotional aspects. In contrast, real-world or ‘everyday’ problems are concrete, tend to be at least somewhat ill-defined, involve many aspects and often have no single best answer. Furthermore, such problems often have socio-emotional aspects and involve taking account of other people’s emotions as well as dealing with the solver’s own emotions. Solving such problems generally involves drawing on prior knowledge or wisdom acquired over the life-span (Baltes & Staudinger, 2000). A possible link between everyday problem solving and QoL in older people has been pointed out by Thornton and Dumke (2005, p.85) who suggest that:

‘... the ability to derive effective solutions to everyday problems is likely to be of tremendous importance in maintaining QoL and independence as people age.’

It has been found that real-world or everyday problem solving is indeed associated with self-rated everyday functioning in activities of daily living (Allaire & Marsike, 2002). However, the presumed association of real-world problem-solving ability with QoL does

not appear to have been examined hitherto. In the present study then, we examined relationships between abstract and real-world problem solving and reported QoL in later life, taking account of a range of possible confounding variables.

Previous research (Baltes & Lang, 1997) indicated that ageing effects may well differ between cognitive functioning dealing with realistic material (e.g. planning a holiday, advising on social-emotional problems) for which accumulated 'wisdom' may be relevant as compared with cognitive functioning dealing with more abstract unfamiliar materials. On the basis of an extensive review, Berg and Klaczinski (1996) concluded that practical problem-solving performance does not show the marked declines with age which are typically found with traditional measures using abstract materials (e.g. Schaie, 1994). A meta-analysis by Thornton and Dumke (2005) suggested that there is some age-related decline in everyday problem solving but the decline is reduced when the problem content is interpersonal. Other recent research supports the view that age-related deficits in planning are more pronounced in abstract tasks and are less pronounced, absent or even reversed in tasks involving familiar settings (Garden, Phillips, & Macpherson, 2001; Phillips, Macleod, & Kliegel, 2005). Increasing age may be associated with better ability to carry out social and emotional problem solving (Blanchard-Fields, Chen, & Norris, 1997). The general findings of a relatively weak or non-existent effect of age on everyday problem solving (until perhaps the upper reaches of age), and the lack of relationship between age and QoL are consistent with the hypothesis that everyday problem-solving ability is linked to QoL. We would expect that, within our sample, everyday problem-solving ability and QoL would be related, but both would be independent of age, particularly when confounding factors such as health are taken into account.

It was hypothesized that links between QoL and performance in older people would be stronger with real-world practical and socio-emotional problem-solving tasks than with abstract problem-solving tasks since the ability to solve real-life problems determines whether one's goals are met. In considering this hypothesis, a number of possibly relevant and potentially confounded variables which could affect QoL, such as socio-economic status, health status, previous level of functioning, gender, mental, social and physical activity patterns and self-perceived level of cognitive functioning, were taken into account.

Methods

Sample

The sample for which data are reported here consisted of 145 older people (between 70 and 91 years of age, mean age = 78.19 years, standard deviation of age = 4.47). An additional seven participants did not complete the testing and their data were excluded. The sample was drawn from a database that was created in a previous study conducted by two of the authors and colleagues (Hanlon, Gilhooly, & Scott, 1998). The database consists of data from the Paisley-Renfrew Epidemiological study (known as MIDSPAN), together with the Scottish morbidity and mortality records. The sample was stratified by gender, age and 'health status' (more healthy vs. less healthy) as indexed by the morbidity history. The 'more healthy' participants were those with total bed days in hospital less than that of the 25th percentile for the MIDSPAN database, whereas the 'less healthy' had total bed days greater than the value of the 75th percentile of the database. Approximately equal numbers were obtained for all combinations of gender, age and health (Table 1).

Table 1. Distribution of participants by age group, gender and health status

Age group		Health status		Total
		More healthy	Less healthy	
70–75	Female	12	16	28
	Male	11	12	23
	Total	23	28	51
76–80	Female	10	11	21
	Male	17	16	33
	Total	27	27	54
81 and above	Female	14	10	24
	Male	7	9	16
	Total	21	19	40

The distribution of the participants by Carstairs postcode deprivation category (Carstairs & Morris, 1991) was as follows: Extremely affluent, 9.7%; Affluent, 8.3%; Average, 34.5%; Deprived, 40%; Very Deprived, 6.9%; Extremely Deprived, 0.7%. The Carstairs index is based on rates of overcrowding, male unemployment, proportion of Social Class IV or V people and proportion of households having no car in the postcode area.

Thus, the present study included more and less healthy participants from a range of socio-economic backgrounds. This distinguishes the present study from most previous studies on cognitive functioning in old age which have generally been biased towards elite groups of older people, who are healthy and primarily middle and upper-middle class; such biases in previous studies would probably reduce the range of scores obtained on cognitive tests and on QoL and hence attenuate correlations.

Procedure

Semi-structured interviews, along with a battery of tests as outlined below, were conducted, either in participants' home or at the University of Paisley. Three sessions were required with each participant. The assessment of current cognitive functioning required two 3-hour testing sessions. A further 2-hour interview gathered data on attitudes and behaviours associated with maintaining good cognitive functioning in old age and QoL measures. This interview also gathered socio-demographic information.

Multiple measures were taken of each facet under consideration: real-world problem solving, socio-emotional problem solving, QoL, everyday activities, self-assessed cognitive functioning and current health. The measures used in the study are described below.

The study was carried out with the ethical approval of the Argyll and Clyde Health Board Research Ethics Committee.

Measures of cognitive functioning

Abstract cognitive functioning tests

The following tests and tasks were used to assess cognitive functioning.

National Adult Reading Test (NART) error score (Nelson, 1991) was used primarily as an indicator of crystallized vocabulary ability (see Crawford, Deary, Starr, & Whalley, 2001). This test requires the participant to read aloud the irregular words.

Wechsler Adult Intelligence Scale (WAIS III, Wechsler, 1997) *matrix reasoning subtest* was used to assess fluid intelligence. This is a pattern completion task in which the items require the participant to select a solution from five response options.

Wechsler Adult Intelligence Scale (WAIS III, Wechsler, 1997) *digit substitution and Wechsler Intelligence Scale for Children* (WISC III, (Wechsler, 1991) digit substitution subtests were used to assess cognitive speed.

Initial letter fluency task in which participants asked to name as many words as they can in 1 minute beginning with the letters F, A and S (FAS Verbal Fluency, see e.g. Lezak, 1995), and *Category Fluency* (name as many fruits, animals and items found in supermarkets as one can, with a 2-minute time limit per category, Lezak, 1995) were used to assess executive control of strategic retrieval processes.

Behavioural Assessment of Dysexecutive Syndrome (BADS, Wilson, Alderman, Burgess, Ernsly, & Evans, 1996). Zoo Map test was used to assess executive planning ability. This test involves planning a route to visit 6 out of the 12 locations set out in a map of a zoo.

Rey's Auditory-Verbal Learning Test (RAVLT, Rey, 1964) was used to assess verbal learning. Fifteen words are presented orally at the rate of one word per second and participants attempt to recall all the words in any order after each presentation.

The Paisley Reading Comprehension Task was developed specifically for this study and was used to assess verbal ability. Similar standardized reading comprehension tests (most are for use with American children) were found to be unsuitable for an older population living in the West of Scotland. Participants read three short passages of text and answered three questions about what they had read after each passage.

Real-world problem-solving tasks

Real-world problem-solving tasks of two main types were developed specifically for this study, namely 'everyday problem solving' and 'socio-emotional problem solving'. There is some evidence that emotional and social problem solving may be less affected by the process of ageing than abstract tasks (Blanchard-Fields *et al.*, 1997).

The everyday and the socio-emotional problem situations were developed through extensive piloting with older people from a similar population to the current participant sample who themselves generated possible problem scenarios from their own life experiences. The scenarios were then presented to other older participants to elicit possible responses and items that stimulated a satisfactory range of responses were retained. The resulting problems consisted of short vignettes in which the study participant is asked to give as many different solutions as possible. Examples are as follows: 'A 68-year-old woman is receiving nuisance phone calls throughout the night but refuses to unplug the phone so that family and friends can reach her in an emergency. What should she do?' (*Everyday problem scenario 6*); 'Following retirement, a man feels that he no longer has any purpose in life. His wife has tried to persuade him to take up a hobby but he is refusing to do this. What should he do?' (*Socio-emotional problem solving scenario 1*). The answers were scored for number of solutions produced (total number). Each solution was then rated for quality on a 3-point scale (0, irrelevant response or response of poor quality; 1, partial solution given and/or the solution does not address all aspects of the questions and/or the solution is unlikely to be effective; 2, the response considers all strands of the problem and is of good quality) and all the solution scores were summed to give an overall score. Piloting indicated high levels of inter-rater agreement in these judgments.

Self-ratings of current cognitive functioning

It was hypothesized that subjective assessments of cognitive functioning could be more strongly related to QoL than objective measures of functioning. Based on previous pilot research by one of the authors (KG), a self-rating questionnaire was developed in which the participants were asked to rate their cognitive functioning on the 13 dimensions listed below. They were asked to rate each 'ability' on a 7-point scale (1, very bad; 7, very good).

- Ability to remember things for a short time
- Ability to remember things from a long time ago
- Ability to remember when to do things
- Ability to concentrate
- Ability to understand written instruction
- Ability to follow spoken instructions
- Ability to solve problems
- Ability to give advice to others to solve their emotional problems
- Ability to make decisions
- Ability to converse in social situations
- Ability to be 'quick on the uptake'
- Ability to be aware of current events
- Ability to be creative.

Behaviours*Frequencies of behaviours possibly relevant to maintaining good mental functioning*

We obtained from participants the frequencies with which they engaged in a range of predominantly physical, mental and social behaviours that might maintain good cognitive functioning and contribute separately to QoL. Each item was given a score of 'numbers of days per year' in which the activity was undertaken. The mental activities used here overlap strongly with the 'high cognitive loading' items in Shinka *et al.*'s (2005) recent Florida Cognitive Activities Scale. The composite total scores were obtained for the three main categories of activity. The activities and their groupings were as follows:

Mental activities	Physical activities	Social activities
Read newspapers	Swimming	See friends
Read books	Dancing	See relatives
Play cards	Keep fit	Social club
Play chess	Golfing	Attend meeting
Do crosswords	Fishing	Voluntary work
Write letters	Gardening	Attend religious service
Work with computer	DIY	
Listen to music/tapes	Walking	
Sews/or knits	Bowling	
Plays bingo		

Health

To assess current health, which can be expected to be strongly linked to QoL, participants completed a questionnaire in which they rated their health on 6-point scales for the following dimensions: physical health, physical health compared with others of same age, extent to which health problems stood in way of doing things, mental health, mental health when compared with others of same age, ability to take care of self and overall health.

Quality of life

QoL was examined using the LEIPAD questionnaire (De Leo *et al.*, 1998). This is a widely used QoL assessment tool for older adults. It assessed QoL on six aspects, viz. physical functioning, depression, self-care, cognition, social functioning and life satisfaction, and an overall summary score was also generated. The scales are oriented such that a low score represents a better QoL. In addition, the Delighted-Terrible Faces scale (Andrews & Withey, 1976) was used for self-ratings of QoL. In this scale, the participants indicated which of the seven faces varying in degree of smiling or scowling best represented their current QoL. Face number 1 is the most smiling and face number 7 is the most scowling. Hence, a low score reflects better QoL. This measure has been found to be reliable and significantly correlated with other measures of QoL (Gilhooly *et al.*, 2005). The Faces Scale was administered at two testing sessions, yielding two measures, Faces 1 and Faces 2.

Current affective state

As there is evidence that subjective judgements of cognitive abilities and QoL are considerably influenced by current affective state, the depression and the anxiety levels of the participants were measured using the Hospital and Anxiety Depression Scale (HADS) developed by Zigmond and Snaith (1983).

Results

Descriptive statistics for the cognitive measures, QoL measures, activity indices, health and deprivation indices are shown in Table 2. Composite scores were created for each of total mental, social and physical activities estimated per year. To correct for skews, the physical and social activity indices were subject to square root transformations.

Cronbach's α values were obtained for the Everyday Problem Solving Scale (.75), the Socio-emotional Problem Scale (.85), the Self-ratings of Current Cognitive Functioning (.83) and Self-rated Health (.60); these results indicate satisfactory levels of internal consistency for the scales. A Pearson correlation of .74 was obtained between the two administrations of the Faces test of QoL, which indicates satisfactory test-retest reliability over a period of at least 1 week.

The overall levels of reported QoL were fairly high, as is often found in surveys of QoL (Gilhooly *et al.*, 2005; Myers & Diener, 1996). The low average Faces scores (low scores = high QoL) arose because ca. 90% of respondents chose one of the three smiling faces to indicate their QoL on both testing occasions. The maximum score which could be obtained on the LEIPAD Summary was 97 which would indicate very poor QoL. The minimum score possible is 0 which would indicate exceptionally high

Table 2. Descriptive statistics for cognitive measures, activity indices (social and physical indices corrected for skews) and QoL measures ($N = 145$)

Measure	Mean	SD	Skew
Everyday problems	21.25	9.57	1.01
Socio-emotional problems	21.75	9.39	1.03
NART	17.35	8.67	0.62
WAIS digit	33.11	12.38	0.34
FAS fluency	37.39	14.34	0.43
WAIS matrix	11.81	5.60	0.28
WISC substitution	41.88	12.63	-0.19
Category fluency	47.25	10.89	0.19
BADS	1.99	9.51	-1.30
RAVLT	0.26	0.62	1.19
Mental activity index	1100.22	55.47	0.76
Physical activity index (Sq Rt)	19.40	7.95	-0.25
Social activity index (Sq Rt)	17.15	6.77	0.02
Faces 1	2.42	0.96	1.06
Faces 2	2.38	0.83	0.56
LEIPAD summary	18.01	9.76	1.06
HADS anxiety	5.7	3.29	0.42
HADS depression	3.27	2.11	0.76

QoL. The obtained mean of 18.01 suggests good levels of satisfaction with most aspects of QoL in our sample.

To clarify the overall pattern of results, factor scores were derived for cognitive functioning, QoL, self-rated health and self-rated cognitive functioning. Principal components extraction and varimax rotation were used in all cases. As can be seen in Table 3, three cognitive function factors emerged: (1) a 'Fluid factor' which loaded on WISC substitution (.763), WAIS digit substitution (.723) and category fluency (.717);

Table 3. Factor analysis of ability measures. Extraction method, principal component analysis; rotation method, varimax with Kaiser normalization ($N = 145$)

Rotated matrix	Factor		
	Fluid	Crystallized	Real-world
Everyday problems	.122	.075	.900
Socio-emotional problems	-.023	.130	.880
NART error score	-.227	-.740	-.003
WAIS digit score	.723	.327	-.042
Category fluency score	.717	-.052	.413
FAS verbal fluency score	.606	.219	.056
BADS zoo map score	.511	.349	-.146
Comprehension score	.066	.836	.168
WAIS matrix reasoning	.380	.626	.097
WISC substitution score	.763	.155	.124
RAVLT trials A1-A5	.250	.454	.379

(2) a 'Crystallized factor' which loaded highly on comprehension (.836) and NART (−.740); (3) a 'Real world' factor which loaded highly on everyday problem solving (.900) and social emotional problem solving (.880).

A single QoL factor emerged from analysis of the Delighted Terrible Faces Scale (first and second administration), LEIPAD Summary and HADS scores. The QoL factor loaded highly on Faces 1 (.796), LEIPAD (.754) and Faces 2 (.724) and clearly but less strongly on HADS Anxiety (.573) and HADS Depression (.691).

A single self-rated health factor emerged from analysis of the self-ratings with high loadings on physical health (.809), relative physical health (.806), daily functioning (.792) and overall health (.738), and lower but substantial loadings on mental health (.672) and relative mental health (.635).

Analysis of the self-ratings of cognitive abilities yielded two factors (Table 4). The first (Cog Fun 1) loaded highly on the following: written instructions (.743), remembering when to do things (.742) and problem solving (.692). The second (Cog Fun 2) loaded highly on: giving advice (.738) and conversation (.738).

Table 4. Factor analysis of self-rated cognitive function. Extraction method, principal component analysis; rotation method, varimax with Kaiser normalization ($N = 145$)

Rotated matrix	Factor	
	Self-rated Cog Fun 1	Self-rated Cog Fun 2
Ability to remember things for a short time	.466	.158
Ability to remember from long time ago	.039	.577
Ability to remember when to do things	.742	−.148
Ability to concentrate	.594	.158
Ability to understand written instructions	.743	.083
Ability to follow spoken instructions	.564	.433
Ability to solve problems	.692	.210
Ability to give advice	.073	.738
Ability to make decisions	.582	.259
Ability to converse in social situations	.240	.738
Ability to be 'quick on the uptake'	.265	.585
Ability to be aware of current events	.595	.242
Ability to be creative	.422	.326

Table 5 presents correlations among the key variables.

It appears from Table 5 that QoL was largely related to self-rated health, self-rated cognitive function, health status (as determined by morbidity history) and real-world problem solving. A regression analysis (Table 6) supported the view that these variables each contributed independently to predicting QoL.

A more stringent simultaneous regression (Table 7) was also carried out in which the additional possibly confounding variables of mental, physical and social activity scores, age, gender and deprivation categories were also entered. The variables of self-rated health, objective health status, self-rated cognitive function and real-world problem solving remained as making significant independent contributions to predicting QoL.

Table 5. Pearson correlations with QoL and predictor variables (N = 145)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. QoL	—													
2. Age	.14	—												
3. Gender	-.04	-.09	—											
4. Fluid Fct.	-.16	-.26	.03	—										
5. Cryst. Fct.	-.09	-.10	.05	.00	—									
6. Real W. Fct.	-.20	-.23	-.25	.00	.00	—								
7. Dep. Cat	.04	.03	.20	-.35	-.08	.05	—							
8. Ment. Act.	-.03	-.13	-.10	.23	.10	.07	.05	—						
9. Phys. Act.	-.10	-.02	.20	-.04	-.03	.04	.10	.03	—					
10. Soc. Act.	-.11	-.12	-.13	.11	.00	.10	.04	.30	.23	—				
11. Health Fct.	.47	.04	-.02	.21	.01	.05	-.15	.02	.06	.04	—			
12. Health St.	.27	-.08	.00	-.07	-.10	.04	.05	.07	-.06	.14	-.36	—		
13. Self Cog 1	-.29	-.11	.01	.21	.21	.05	-.03	.07	.05	.05	.28	.09	—	
14. Self Cog 2	-.23	-.23	.08	.09	.05	.14	.08	.04	.05	.09	.03	.08	.00	—

Key: Fluid Fct, fluid factor; Cryst. Fct., crystallized factor; Real W. Fct., real-world factor; Dep. Cat., deprivation category score; Ment. Act., mental activity score; Phys. Act., physical activity score; Soc. Act., social activity score; Health Fct., self-rated health factor; Health St., health status; Self Cog 1, self-rated cognitive factor score 1; Self Cog 2, self-rated cognitive factor score 2.
 Bold, $p < .01$; italic, $p < .05$.

Table 6. Regression coefficients for significant simple predictors regressed on QoL (N = 145)

Predictors	Standardized coefficients		
	β	t	Sig.
Real-world factor	-0.152	-2.172	.03
Health status	0.159	2.132	.03
Self-rated health	-0.350	-4.548	.00
Self-rated Cog Fun 1	-0.168	-2.330	.02
Self-rated Cog Fun 2	-0.212	-3.021	.00

Table 7. Regression coefficients for an extended range of predictors regressed on QoL (N = 145)

Predictors	Standardized coefficients		
	β	t	Sig.
Real-world factor	0.04	-0.157	-2.038
Health status	0.167	2.147	0.03
Self-rated health	-0.349	-4.349	0.00
Self-rated Cog Fun 1	-0.145	-1.905	0.05
Self-rated Cog Fun 2	-0.194	-2.617	0.01
Age	0.047	0.593	ns
Gender	-0.074	-0.921	ns
Deprivation	0.012	0.146	ns
Fluid factor	-0.004	-0.048	ns
Crystallized factor	-0.047	-0.630	ns
Social activity	-0.086	1.093	ns
Physical activity	-0.030	-0.399	ns
Mental activity	0.024	0.309	ns

Discussion

Similar to Gow *et al.* (2005), we found no relationship between abstract tests of cognitive functioning and QoL in old age. However, it was found that real-world problem solving was predictive of reported QoL, with those performing better on the real-world problems reporting higher QoL. The size of the relationship of real-world problem solving with QoL, as indexed by beta-weights in the multiple regressions (Tables 6 and 7), was similar to that between objective health status and QoL. Measures of self-rated health and self-rated cognitive function were more strongly linked with QoL than was real-world problem solving. The participants' subjective dissatisfaction with their cognitive functioning was linked to lower levels of QoL. This association may be explained in that individuals who are being frustrated in attaining their goals through cognitive failures will likely rate both their QoL and cognitive abilities lower than others who are not thus frustrated. However, the self-rating measures of health and cognitive functioning overlapped moderately in content with the LEIPAD and HADS scales, which contributed strongly to the QoL factor, and so some of the link between the self-rating measures of health and cognitive functioning and QoL may be artifactual. In contrast,

the link between QoL and real-world problem solving does not involve such possible artifactual effects.

Our study slightly differed from Gow *et al.*'s (2005) in that we measured QoL using a factor score derived from factor analysis of a number of measures rather than a single score based on one test and hence the present measure is a broader based index. The result reported here is consistent with the view that life satisfaction or QoL is affected by ability to solve practical, real-life problems. It is plausible to suggest that the ability to tackle real-life problems depends more on practical lifetime experience and less on fluid abstract ability; hence, the relationship between real-world problem solving and QoL, and the lack of relationship between abstract problem solving and QoL. The differential association of QoL with real-world problem solving, but not with fluid ability, supports the dissociation of these two abilities which has been also indicated by other studies (e.g. Berg & Klaczinski, 1996).

The simple correlation of age with the real-world problem-solving factor ($r = -.23$) was significant. This suggests that real-world problem-solving ability or 'wisdom' was declining as well as the 'mechanics' of cognition (Lindenberger & Baltes, 1997) over the age range tested in our sample (70–91 years). This result is consistent with Baltes and Staudinger's (2000) report that measures of 'wisdom' (similar to our real-world tasks) showed little change with age over the range of 25–75 years, but with some decline from the age of 75 onwards. However, as with previous studies (Argyle, 1999), there was no independent association of age and QoL when other confounding factors were taken into account.

For future studies, it would be desirable to establish further the reliability and validity of the real-world problem-solving scales and to address the issue of restricted range in QoL scores. Although internal consistency of the real-world scales was satisfactory, test-retest reliability and validity in terms of relationships with other related tasks, such as those used by Denney and Pearce (1989) and Blanchard-Fields *et al.* (1997), should be investigated further. QoL scores in surveys tend to be restricted in range around the higher QoL levels and this will tend to attenuate effects in correlational studies such as the present one. A possible avenue for future research would be to select participants as representing high and low QoL scorers, and to examine differences in predictor variables of interest between the high and the low QoL groups, for example by means of discriminant function analyses.

In conclusion, the present study provides new evidence supporting the hypothesis that real-world or everyday problem-solving ability is associated with QoL in older people and replicates previous findings that abstract problem-solving ability is not related to QoL.

Acknowledgements

This study was carried out as part of a project funded by the Growing Older Programme of the Economic and Social Research Council, Grant number L480 25 4029 (Principal Investigator, M. L. Gilhooly). Thanks are due to Margaret Lothian, Karen Dunleavy and Susan Caldwell for assistance in data collection.

References

- Allaire, J. C., & Mariske, M. (2002). Everyday cognition: Age and intellectual ability correlates. *Psychology and Aging, 14*, 627–644.

- Andrews, F. M., & Withey, S. B. (1976). *Social indicators of well being: American's perceptions of life quality*. New York: Plenum.
- Argyle, M. (1999). Causes and correlates of happiness. In D. Kahnema, E. Diener, & N. Schwartz (Eds.), *Well-being: The foundations of hedonic psychology*. New York: Sage.
- Baltes, M. M., & Lang, F. R. (1997). Everyday functioning and successful aging: The impact of resources. *Psychology and Aging, 12*, 466-473.
- Baltes, P. B., & Staudinger, U. M. (2000). Wisdom: A metaheuristic (pragmatic) to orchestrate mind and virtue toward excellence. *American Psychologist, 55*, 122-136.
- Berg, C. A., & Klaczynski, P. A. (1996). Practical intelligence and problem-solving: Searching for perspectives. In F. Blanchard-Fields & T. M. Hess (Eds.), *Perspectives on cognitive change in adulthood and aging* (pp. 323-357). New York: McGraw-Hill.
- Blanchard-Fields, F., Chen, Y., & Norris, L. (1997). Everyday problem-solving across the adult lifespan: Influence of domain specificity and cognitive appraisal. *Psychology and Aging, 12*, 684-693.
- Carstairs, V., & Morris, G. (1991). *Deprivation and health in Scotland*. Aberdeen: Aberdeen University Press.
- Crawford, J. R., Deary, I. J., Starr, J., & Whalley, L. J. (2001). The NART as an index of prior intellectual functioning: A retrospective validity study covering a 66-year interval. *Psychological Medicine, 31*, 451-458.
- Deary, I. J. (2001). *Intelligence: A short introduction*. Oxford: Oxford University Press.
- Deiner, E. (1984). Subjective well-being. *Psychological Bulletin, 235*, 542-575.
- Deiner, E., Emmons, R. A., Larsen, R. J., & Griffen, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*, 71-75.
- DeLeo, D., Diekstra, R. F. W., Lonquist, J., Trabucchi, M., Cleiren, M. H. P. D., Frisoni, G. B., *et al.* (1998). LEIPAD, an internationally applicable instrument to assess quality of life in the elderly. *Behavioral Medicine, 24*, 17-28.
- Denney, N. W., & Pearce, K. A. (1989). A developmental study of practical problem solving in adults. *Psychology and Aging, 4*, 438-442.
- Garden, S., Phillips, L. H., & MacPherson, S. E. (2001). Mid-life aging, open-ended planning and laboratory measures of executive function. *Neuropsychology, 15*, 472-482.
- Gilhooly, M., Gilhooly, K., & Bowling, A. (2005). Quality of life: Meaning and measurement. In A. Walker (Ed.), *Understanding quality of life in old age*. Maidenhead: Open University Press.
- Gow, A. J., Whiteman, M. C., Pattie, A., Whalley, L., Starr, J., & Deary, I. J. (2005). Lifetime intellectual function and satisfaction with life in old age: Longitudinal cohort study. *British Medical Journal, 331*, 141-142.
- Hanlon, P., Gilhooly, M., & Scott, S. (1998). *Determinants of Good and Poor Health: A Comparison of Two Subgroups of the Paisley Renfrew Study*. Final report on Grant Number K/OPR/2/D291 to the Chief Scientist Office, Scotland.
- Lezak, M. D. (1995). *Neuropsychological assessment* (3rd ed.). New York: Oxford University Press.
- Lindenberger, U., & Baltes, P. B. (1997). Intellectual functioning in old and very old age: Cross sectional results from the Berlin aging study. *Psychology and Aging, 12*, 410-432.
- Myers, D. G., & Diener, E. (1996). The pursuit of happiness. *Scientific American, 274*, 54-56.
- Nelson, H. E. (1991). *National adult reading test (NART)* (2nd ed.). Windsor: NFER-Nelson.
- Phillips, L. H., MacLeod, M., & Kliegel, M. (2005). Age, the frontal lobes and executive functioning. In G. Ward & R. Morris (Eds.), *The cognitive psychology of planning*. Hove, UK: Psychology Press.
- Rey, A. (1964). *L'Examen clinique en psychologie*. Paris: Press Universitaire de France.
- Thornton, W. J. L., & Dumke, H. A. (2005). Age differences in everyday problem solving and decision making effectiveness: A meta-analytic review. *Psychology and Aging, 20*, 85-99.
- Schaie, K. W. (1994). The course of adult intellectual development. *American Psychologist, 49*, 304-313.

- Schinka, J. A., McBride, A., Vanderploeg, R. D., Tennyson, K., Borenstein, A. R., & Mortimer, J. A. (2005). Florida cognitive activities scale: Initial development and validation. *Journal of the International Neuropsychological Society, 11*, 108-116.
- Wechsler, D. (1997). *Wechsler adult intelligence scale, UK. Administration and scoring manual* (3rd ed.). London: Psychological Corporation.
- Wechsler, D. (1991). *Wechsler intelligence scale for children* (3rd ed.). London: The Psychological Corporation.
- Wilson, B. A., Alderman, N., Burgess, P. W., Ernsley, H., & Evans, J. J. (1996). *BADS: Behavioural assessment of the Dysexecutive Syndrome*. Bury St Edmunds, UK: Thames Valley Test Co.
- World Health Organisation Quality of Life Group (1993). *Measuring quality of life: The development of the World health organisation quality of life instrument (WHOQOL)*. Geneva: World Health Organisation.
- Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica, 67*, 361-370.

Received 17 April 2006; revised version received 25 August 2006