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THE KNOWLEDGE OF MEMORY AGING QUESTIONNAIRE: EFFECTS OF ADDING A "DON'T KNOW" RESPONSE OPTION

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The Knowledge of Memory Aging Questionnaire (KMAQ) was designed to measure laypersons' knowledge of memory changes in late life for educational or research purposes. The KMAQ contains 28 items in a true-false format. Half of the questions pertain to normal memory aging and the other half cover pathological memory deficits due to nonnormative factors, such as adult dementia. In this article, we report the addition of a "don't know" response option to the KMAQ. Results of three experiments utilizing the KMAQ-DK version are presented. Implications for the design of educational programs for students, older adults, and service providers are considered.

Forgetfulness in everyday life is a common experience. For older adults, lapses of memory may be especially worrisome, raising concern over whether forgetfulness is signaling the onset of adult dementia (Commissaris, Verhey, Ponds, Jolles, & Kok, 1994; Reese, Cherry,

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& Norris, 1999). Fear of pathological memory aging, especially Alzheimer's Disease (AD), may undermine older adults' health status (Centofanti, 1998). Memory lapses in healthy older adults, however, are quite different in comparison to the severe memory dysfunction observed in persons with progressive dementia syndromes, such as AD (see Cherry & Plauche, 1996; Grober & Buschke, 1987). The *Knowledge of Memory Aging Questionnaire* (KMAQ; Cherry, West, Reese, Santa Maria, & Yassuda, 2000) was designed to measure laypersons' knowledge of memory changes in adulthood for educational or research purposes. The KMAQ contains 28 items in a true-false format, where half of the questions address knowledge of normal memory changes that occur in later life as a result of maturational processes (i.e., normal memory aging), and the other half address knowledge of pathological memory changes that may be due to non-normative factors that affect memory functioning in older adults (i.e., physiological or psychopathological conditions, pharmacological agents, and/or adult dementia).

Cherry et al. (2000) conducted an initial series of four studies with the KMAQ using samples of mental health professionals, college students, and community-dwelling older adults. They found that items that were counter to common stereotypes of memory aging were more likely to be answered incorrectly, particularly with respect to normal memory aging items, suggesting that the KMAQ is sensitive to common misperceptions of cognitive aging. They also found that specific training on memory changes in adulthood improved performance on the KMAQ in a sample of college students, confirming that the instrument is sensitive to instruction. Reese, Cherry, and Copeland (2000) found that older adults scored better on the KMAQ than did younger adults. Both age groups were more accurate on pathological compared to normal memory aging items. Follow-up analyses within the specific content areas comprising normal and pathological memory aging yielded a mixed pattern of results. For normal memory aging items, the Age $\times$ Topical Rubric interaction effect was significant. Older adults were more accurate than younger adults on items related to episodic memory phenomena, encoding/retrieval factors, and mnemonics/memory strategies. The two age groups performed comparably on items related to memory organization/systems and individual difference and contextual influences on memory. For the pathological memory aging items, a significant two-way interaction occurred. Older adults gave more accurate responses on items related to the identification of abnormal deficits, mental health conditions affecting memory, and physical health conditions affecting memory than did younger adults. The age groups did not differ on items related

to examples of abnormal deficits or adult dementia/AD. Reese et al.'s findings are interesting, as they suggest specific content areas where people might benefit from instruction. However, the mixed patterns of age differences observed across both the normal and pathological memory content areas may also be due to differential rates of guessing in the younger versus older adult groups.

There were two primary aims in the present research. Our first goal was to examine the effects of adding a "don't know" response option to the KMAQ. Courtenay and Weidemann (1985) suggest that a strict true-false format does not allow for the separation of true misconceptions of aging from lack of knowledge on the topic. In Experiment 1, we compared college students' performance on two versions of the KMAQ. Version 1 had only two response options (true-false), as in Cherry et al. (2000) and Reese et al. (2000). Version 2 contained the true-false options and added a third response alternative of "don't know" (DK). By providing an opportunity to answer DK, we expected that the likelihood of random guessing would be lessened, resulting in a more sensitive assessment of peoples' memory knowledge compared to the strictly true-false version. In Experiment 2, we used a pretest-posttest format to examine the effects of instruction on the frequency of DK response endorsement in college students who attended a two-part lecture series on memory in adulthood.

Our second goal was to provide new evidence on adult age differences in knowledge of memory aging issues. In Experiment 3, we administered the KMAQ with the DK option (KMAQ-DK) to college students and older adults. Item analyses were expected to reveal areas of memory knowledge where younger and older adults differ. Taken together, the results of these studies were expected to yield new information concerning laypersons' knowledge of memory aging. These outcomes have important applied implications for the design of educational programs that focus on increasing knowledge of memory aging in college curriculum, as well as for the general public (e.g., Turner & Pinkston, 1993).

EXPERIMENT 1

Method

Participants

A total of 202 Louisiana State University undergraduate students (M age = 20.26 years, SD = 2.1 years; 145 females and 57 males) completed the questionnaire in exchange for extra credit points to apply in their psychology course. Half of the participants completed

the original two-option, true-false version of the KMAQ (Version 1), and the other half completed the three-option version that included the "don't know" response option (KMAQ-DK, Version 2).

Results and Discussion

A 2×2 mixed ANOVA was conducted on the proportion correct scores with questionnaire (Version 1, Version 2) as a between-group factor and question type (normal, pathological) as a repeated measure factor (see Table 1)[1]. This analysis yielded a main effect of questionnaire, $F(1, 200) = 8.12$, $p = .005$. Proportionately more items were answered correctly on Version 2 of the KMAQ with the DK response option ($M = .70$) than on Version 1 of the KMAQ without this option ($M = .66$). The main effect of question type was also significant, $F(1, 200) = 9.36$, $p = .003$. Pathological memory aging items ($M = .70$) were answered correctly more often than normal memory aging items ($M = .67$), replicating Reese et al. (2000).

The increase in proportion correct scores on Version 2 of the KMAQ relative to Version 1 suggests that guessing was reduced as a result of the availability of the DK response option. Interestingly, participants endorsed the DK option more often on pathological than normal questions. The means, in order, were .17 and .11, a significant difference, $t(100) = 3.97$, $p < .01$. One interpretation of this result is that college students may be less knowledgeable about certain aspects of pathological memory aging, or less confident of their knowledge compared to normal memory aging. Alternatively, college students' knowledge of normal memory aging may be influenced by stereotypical views that portray a negative image of cognitive competence in late life, which would account for their less frequent DK response endorsement and poorer performance on normal compared to pathological items. Further discussion of this result will be delayed until the results of Experiments 2 and 3 are presented.

[1]We calculated proportion scores to control for the possibility that participants' might differentially endorse the DK option for normal items (or for pathological items), and to permit comparisons across the two versions of the KMAQ. For Version 1, we calculated separate proportion scores for each participant for the number correct on the normal memory aging items (14) and the pathological memory aging items (14). For Version 2, normal memory aging proportion scores were calculated for each participant by dividing the number correct (normal items) by the total (14) minus the number of "don't know" responses to normal memory aging questions. Pathological memory aging proportion scores were calculated by dividing the number correct (pathological items) by the total (14) minus the number of "don't know" responses to pathological memory aging questions.

TABLE 1 Mean Proportion Correct and "Don't Know" Responses as a Function of Instrument and Question Type in Experiment 1

	Instrument			
	Version 1 KMAQ without "Don't Know" option		Version 2 KMAQ with "Don't Know"	
	M	*SD*	*M*	*SD*
Question Type/DK option				
Normal	0.64	0.14	.70	0.13
DK Normal	—	—	.11	0.13
Pathological	0.68	0.10	.70	0.13
DK Pathological	—	—	.17	0.15

EXPERIMENT 2

In Experiment 2, we examined the effects of instruction about memory aging issues on the frequency of college students' endorsement of the DK response option. Cherry et al. (2000, Study 3) found that a two-part lecture series on memory in adulthood improved college students' response accuracy on the KMAQ using a pretest-posttest format. However, the KMAQ administered in that study did not include a DK response option, making it difficult to separate the effects of guessing on performance outcomes (Courtenay & Weidemann, 1985). In the present study, we utilized the same two-part lecture series as in Cherry et al. (2000, Study 3), with pre- and posttest administrations of the KMAQ-DK. We expected that the number of DK responses endorsed would decrease as a result of specific instruction on memory aging issues. The proportion correct on the KMAQ-DK also was expected to increase following instruction, which would confirm the reliability and generality of Cherry et al.'s (2000, Study 3) findings.

Method

A total of 44 undergraduate students (M age = 23.67 years, SD = 6.79 years; 7 males and 37 females) enrolled in a lifespan developmental psychology course at Louisiana State University were given the KMAQ-DK before and after a two-part lecture series that broadly covered normal and pathological changes in memory in later adulthood. The KMAQ-DK pretest was given to obtain baseline

performance. The posttest was given after the lecture series and seven days after the first administration of the KMAQ-DK.

Results and Discussion

For each participant, proportion scores for normal and pathological memory aging items were calculated in the same manner as in Experiment 1 for the KMAQ-DK version. We analyzed these data according to the following plan. First, we conducted separate ANOVAs on the proportion of DK responses and proportion correct scores to examine the effects of instruction on these two dependent measures. Mean proportion correct and mean proportion DK responses appear in Table 2. Next, we conducted multivariate analyses of variance (MANOVA) on the proportion correct scores by topical rubric to determine which of the specific content areas of the KMAQ-DK showed the greatest benefit of instruction[2]. MANOVAs were conducted separately for the normal and pathological memory aging items. In all cases where significant MANOVA effects were obtained, we conducted follow-up univariate ANOVAs to identify the locus of significant differences in performance. We conducted item analyses for the proportion correct and proportion of DK responses to provide further insight into the specific items showing the greatest improvement following instruction.

Analyses of "Don't Know" Responses

A 2×2 repeated measures ANOVA on the proportion of DK responses with time of test (pretest, posttest) and question type (normal, pathological) as factors yielded a significant main effect of

TABLE 2 Mean Proportion Correct and "Don't Know" Responses as a Function of Test and Question Type in Experiment 2

	Pretest		Posttest	
	M	*SD*	*M*	*SD*
Question Type/DK option				
Normal	0.68	0.14	0.76	0.13
DK Normal	0.06	0.09	0.04	0.10
Pathological	0.72	0.15	0.83	0.11
DK Pathological	0.06	0.11	0.02	0.05

[2]We did not conduct a MANOVA on the DK response scores, due to the low frequency of DK response endorsement for certain questions on the KMAQ-DK.

time of testing, F (1, 43) = 6.32, $p = .02$. As expected, fewer DK responses occurred at posttest than at pretest, (see Table 2). The main effect of question type was not significant. The interpretation of these effects was qualified by a significant Time of Test × Question Type interaction effect, F (1, 43) = 4.36, $p = .04$. Pairwise comparisons (t tests) revealed that for normal memory aging items, the proportion of DK responses did not differ from pretest to posttest, with means of .06 and .04, respectively. In contrast, for pathological memory aging items, mean pretest DK responses (.06) exceeded the mean posttest DK responses (.02), a significant difference, t (43) = 3.26, $p < .01$.

Analyses of Proportion Correct

This analysis was conducted to permit direct comparisons with Cherry et al. (2000, Study 3). A 2 × 2 repeated measures ANOVA on the proportion correct scores with time of testing (pretest, posttest) and question type (normal, pathological) as factors yielded a significant main effect of time of testing, F (1, 43) = 33.99, $p < .001$. More items were answered correctly at posttest ($M = .80$) than at pretest ($M = .70$), replicating Cherry et al. and confirming the sensitivity of the KMAQ-DK to instruction. The main effect of question type also was significant, F (1, 43) = 7.15, $p = .01$. More pathological memory aging items were answered correctly ($M = .78$) than normal memory aging items ($M = .72$). The Time of Testing × Question Type interaction was not significant. In Cherry et al., the question type effect was not significant, but the Time of Testing × Question Type interaction effect was, due to a larger pre- to posttest improvement for pathological items compared to normal memory aging items.

Analyses of Proportion Correct by Topical Rubric

For each participant, we calculated separate proportion scores for the 10 topical rubrics contained within the KMAQ-DK (5 normal, 5 pathological). Proportion scores were based on the number of items answered correctly within a rubric, divided by the total number of questions, minus the number of DK responses within the same rubric[3]. Means appear in Table 3.

We conducted a 2 × 5 MANOVA with time of testing and topical rubric (normal: memory organizations/systems, episodic memory

[3]For the MANOVAs in Experiment 2, we dropped two participants from the analyses of normal items and four participants from the pathological items analyses because these persons answered DK for all items within one or more of the rubrics, resulting in missing data for the purpose of the analyses of response accuracy by topical rubric.

TABLE 3 Mean Proportion Correct on as a Function of Time of Testing and Topical Rubric Experiment 2

	Time of Testing			
	Pretest		Posttest	
Topical rubric/Question type	*M*	*SD*	*M*	*SD*
Normal memory aging items				
Memory organization/systems	.42	.25	.51	.23
Episodic memory phenomena	.68	.21	.72	.19
Encoding/retrieval factors	.68	.25	.85	.25
Mnemonics/memory strategies	.89	.26	.89	.24
Individual difference/contextual influences	.85	.22	.88	.19
Pathological memory aging items				
Types of abnormal deficits	.80	.20	.77	.23
Identification of abnormal deficits	.57	.26	.88	.18
Mental health conditions and memory	.65	.36	.71	.27
Physical conditions and memory	.76	.28	.92	.16
Adult dementia/AD	.79	.16	.83	.18

phenomenon, encoding/retrieval factors, mnemonics/memory strategies, individual difference/contextual influences on memory) as repeated measures factors. This analysis yielded a significant main effect of time of testing, $F\,(1, 41) = 11.07$, $p < 0.01$. More items were answered correctly on posttest ($M = .77$) compared to pretest ($M = .70$). The main effect of topical rubric was also significant, $F\,(4, 38) = 31.80$, $p < 0.001$. Response accuracy was highest for mnemonics/memory strategies ($M = .89$) and individual difference/contextual influences ($M = .87$), which did not differ from each other. Encoding/retrieval factors ($M = .77$) and episodic memory phenomenon ($M = .70$) were less than the first two rubrics, but did not significantly differ from each other. Memory organizations/system followed ($M = .47$) and was significantly lower than all other rubrics. The Time of Testing $\times$ Topical Rubric interaction effect was significant, $F\,(4, 38) = 2.93$, $p = 0.03$. Follow-up one-way ANOVAs confirmed that significant pre- to posttest differences occurred for memory organization/systems and encoding/retrieval factors, but none of the other pre- to posttest differences in response accuracy were significant.

A 2×5 MANOVA with time of testing and topical rubric (pathological: types of abnormal deficits, identification of abnormal deficits, mental health conditions and memory, physical health conditions and memory, adult dementia/AD) yielded a significant time of testing main effect, $F\,(1, 39) = 24.94$, $p < 0.001$. More items were answered correctly

on posttest ($M = .82$) compared to pretest ($M = .71$). The main effect of topical rubric was also significant, $F\ (4,\ 36) = 4.82$, $p < 0.01$. Response accuracy was highest for physical health conditions affecting memory ($M = .84$), adult dementia/AD ($M = .81$) and types of abnormal deficits ($M = .79$), which did not differ from each other. Identification of abnormal deficits ($M = .73$) was significantly lower than the first two, but not types of abnormal deficits. Mental health conditions and memory followed ($M = .68$), and was significantly lower than all other rubrics except identification of abnormal deficits. The Time of Testing $\times$ Topical Rubric interaction effect was significant, $F(4,\ 36) = 9.90$, $p = 0.001$. Follow-up one-way ANOVAs confirmed that significant pre- to posttest differences occurred for identification of abnormal deficits and physical conditions and memory, but no other pre- to posttest difference in response accuracy was significant.

Item Analysis

We conducted an item analysis to provide a fine-grained examination of the individual questions that showed the largest DK endorsement initially, and the greatest reduction in DK responses from pretest to posttest following instruction. The improvement in response accuracy following instruction is also of interest and is therefore reported here (cf. Cherry et al., 2000, Study 3). Table 4 presents the proportions correct, incorrect, and "don't know" for each item, organized by topical rubric, for pretest and posttest administrations of the KMAQ-DK.

At pretest, the questions (Q) initially showing the largest proportion of DK responses were Q7, Q24, and Q11 with means of .25, .20, and .11, respectively. Q7, a pathological item under Physical Health Conditions Affecting Memory, pertains to the adverse effects of cardiovascular medications on memory. Q24, a normal item under Mnemonics/Memory Strategies, taps the history of modern day memory improvement methods. Q11, a pathological item under Mental Health Conditions Affecting Memory, refers to memory complaints and early AD.

Items showing the largest reduction in DK responses from pre- to posttest were Q7, Q6, Q8, Q9, and Q15. Q7 (cardiovascular mediations and memory), showed the largest pre- to posttest reduction (from .25 to .00). Q6, a normal item under Episodic Memory Phenomenon that pertains to relatively preserved prospective memory performance in adulthood, showed the next largest pre- to posttest reduction in DK responses (from .09 to .00). The next three items, Q8, Q9, and Q15 (all pathological items), showed the same drop in DK responses from pre- to posttest (from .09 to .02). Q8, under Mental Health Conditions

TABLE 4 Mean Proportion Correct, Incorrect, and "Don't Know" Responses per Item by Time of Testing and Topical Rubric in Experiment 2

	Pretest			Posttest		
Topical rubric	Correct	Incorrect	DK	Correct	Incorrect	DK
Normal memory aging items						
Memory organization/ systems						
Item 3	.45	.52	.02	.61	.34	.05
Item 10	.27	.68	.05	.20	.80	.00
Item 20	.48	.48	.05	.68	.27	.05
Mean	.40	.56	.04	.50	.47	.03
Episodic memory phenomena						
Item 1	.91	.09	.00	.91	.07	.02
Item 6	.20	.70	.09	.43	.57	.00
Item 17	.84	.11	.05	.84	.16	.00
Mean	.65	.30	.05	.73	.27	.01
Encoding/retrieval factors						
Item 2	.30	.70	.00	.73	.25	.02
Item 13	.77	.18	.05	.84	.16	.00
Item 14	.93	.05	.02	.93	.07	.00
Mean	.67	.31	.02	.83	.16	.01
Mnemonics/memory strategies						
Item 24	.80	.00	.20	.77	.05	.18
Item 27	.75	.16	.09	.73	.18	.09
Mean	.77	.08	.15	.75	.11	.14
Individual difference/ contextual influences						
Item 16	.70	.25	.05	.84	.14	.02
Item 21	.91	.02	.07	.86	.09	.05
Item 23	.73	.23	.05	.77	.16	.07
Mean	.78	.17	.05	.83	.13	.05
Pathological memory aging Items						
Types of abnormal deficits						
Item 5	.50	.50	.00	.50	.48	.02
Item 25	.86	.09	.05	.77	.20	.02
Item 26	.93	.02	.05	.98	.02	.00
Mean	.77	.20	.03	.75	.23	.02
Identification of abnormal deficits						
Item 9	.77	.14	.09	.95	.02	.02
Item 12	.27	.70	.02	.86	.14	.00
Item 19	.66	.32	.02	.80	.16	.05
Mean	.57	.39	.04	.87	.11	.02

(*Continued*)

TABLE 4 (*Continued*)

	Pretest			Posttest		
Topical rubric	Correct	Incorrect	DK	Correct	Incorrect	DK
Mental health conditions & memory						
Item 8	.70	.20	.09	.93	.05	.02
Item 11	.48	.41	.11	.45	.50	.05
Mean	.59	.31	.10	.69	.27	.03
Physical conditions & memory						
Item 4	.57	.39	.05	.75	.20	.05
Item 7	.55	.20	.25	.95	.05	.00
Item 28	.93	.05	.02	1.0	.00	.00
Mean	.68	.21	.11	.90	.08	.02
Adult dementia/AD						
Item 15	.27	.64	.09	.50	.48	.02
Item 18	1.0	.00	.00	1.0	.00	.00
Item 22	.95	.00	.05	.93	.07	.00
Mean	.74	.21	.05	.81	.18	.01

Affecting Memory, refers to the similarity in symptoms with intense grief and early AD. Q9, under Identification of Abnormal Deficits, refers to conducting a physical exam if AD is suspected. Q15, under Adult Dementia/AD pertains to the increased probability of AD in the oldest-old (those over 85). Interestingly, four of the five items showing the largest reduction in DK responses from pre- to posttest pertain to pathological memory aging. Thus, specific instruction that includes coverage of pathological memory aging issues may be especially beneficial for college students.

EXPERIMENT 3

In Experiment 3, we examined age differences in DK response endorsement between college students and community-dwelling older adults. We expected that older adults would be less likely to answer DK, as they have greater personal experience with memory aging issues and perhaps more a priori interest in this topic than do college students. We also expected to replicate age effects favoring the older adults in the analyses of proportion correct by question type and also in the analyses of age by topical rubric. This pattern of outcomes would confirm the reliability and generality of Reese et al.'s (2000) findings.

Method

Participants

A total of 90 persons participated in the study. Younger adults were 49 undergraduate students (M age = 22.4 years, SD = 3.1 years; 11 males and 38 females) enrolled in a psychology of aging course at Louisiana State University, who completed the questionnaire as an in-class exercise. There were 41 community-dwelling older adults (M = 78.9 years, SD = 5.6; 16 males and 25 females) who completed the KMAQ-DK version as a part of an unrelated project. All were living independently at a local Continuing Care Retirement Center in Baton Rouge, LA.

Results and Discussion

These data were scored in the same manner as in Experiment 2. Mean proportion correct scores and mean proportion DK responses appear in Table 5.

Analyses of "Don't Know" Responses

A 2 × 2 mixed ANOVA on the DK response proportion scores yielded a significant main effect of age, F (1, 88) = 16.59, $p < .001$, favoring the younger adults who endorsed the DK option more often (M = .18) than did the older adults (M = .08). The question type main effect was not significant. The Age × Question Type interaction effect was significant, F (1, 88) = 4.20, p = .04. As can be seen in Figure 1, the magnitude of the age difference was relatively greater for pathological items (mean difference of 0.12) compared to normal items (mean difference of .07), accounting for the statistical significance of the interaction. Younger adults answered DK for pathological items somewhat more often than for normal items, although this difference was not significant. Older adults endorsed DK more often for normal compared to pathological memory aging items, but not significantly so.

TABLE 5 Mean Proportion Correct and "Don't Know" Responses as a Function of Age and Question Type in Experiment 3

	Young		Old	
Question Type/DK option	*M*	*SD*	*M*	*SD*
Normal	0.69	0.14	0.75	0.12
DK normal	0.16	0.13	0.09	0.09
Pathological	0.73	0.12	0.83	0.14
DK pathological	0.19	0.15	0.07	0.10

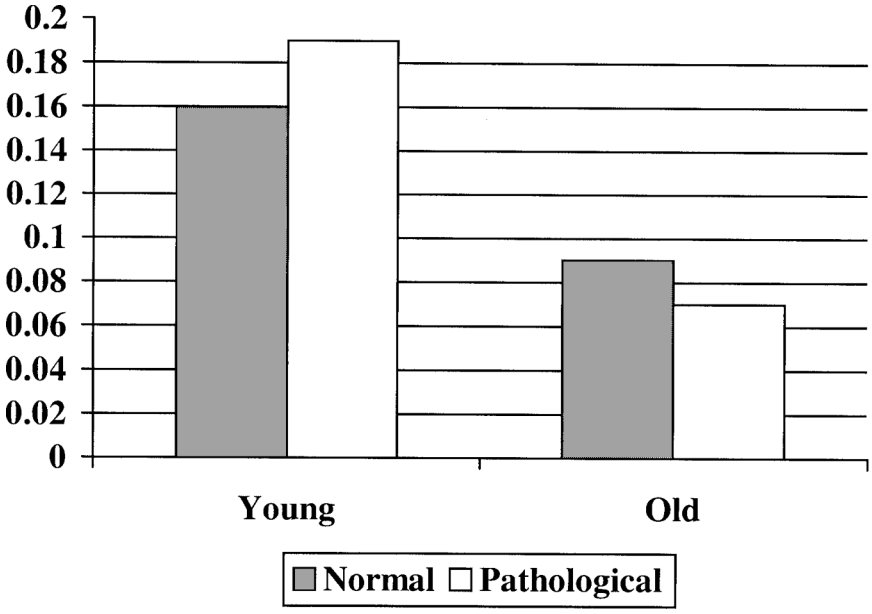

FIGURE 1 Mean proportion of DK responses as a function of age and question type in Experiment 3.

Analyses of Proportion Correct

A 2×2 mixed ANOVA was conducted with age (young, old) as a between group variable and question type (normal, pathological) as a repeated measure factor. This analysis yielded a main effect of age, F $(1, 88) = 14.33$, $p < .001$, favoring the older adults who answered more items correctly ($M = .79$) than did the younger adults ($M = .71$). The main effect of question type was also significant, F $(1, 88) = 9.67$, $p = .003$. More pathological memory aging items were answered correctly than were normal memory aging items, with means of .78 and .72, respectively. The Age $\times$ Question Type interaction was not significant. These results replicate Reese et al. (2000).

Analyses of Proportion Correct by Topical Rubric

For each participant, separate proportion scores were calculated for all topical rubrics as in Experiment 2[4]. Means appear in Table 6. We

[4]For the MANOVAs in Experiment 3, we dropped nine participants from the normal items analysis and seven from the pathological items analysis because these persons answered DK for all items within one or more of the topical rubrics.

TABLE 6 Mean Proportion Correct on as a Function of Age and Topical Rubric Experiment 3

	Age			
	Young		Old	
Topical rubric/Question type	*M*	*SD*	*M*	*SD*
Normal memory aging items				
Memory organization/systems	.45	.32	.40	.26
Episodic memory phenomena	.71	.26	.78	.31
Encoding/retrieval factors	.68	.25	.87	.18
Mnemonics/memory strategies	.90	.26	.96	.18
Individual difference/contextual influences	.85	.26	.89	.18
Pathological memory aging items				
Types of abnormal deficits	.90	.18	.92	.15
Identification of abnormal deficits	.51	.29	.72	.25
Mental health conditions and memory	.55	.43	.77	.30
Physical conditions and memory	.76	.29	.90	.19
Adult dementia/AD	.81	.23	.82	.19

conducted a 2×5 mixed MANOVA with age (young, old) as a between group variable and topical rubric (normal: memory organizations/systems, episodic memory phenomenon, encoding/retrieval factors, mnemonics/memory strategies, individual difference/contextual influences on memory) as a repeated measures factor. This analysis yielded a significant main effect of age, $F\ (1,\ 79) = 4.83$, $p < 0.03$, favoring the older adults who were more accurate ($M = .78$) than the younger adults ($M = .72$). The main effect of topical rubric also was significant, $F\ (4,\ 76) = 47.99$, $p < 0.001$. Response accuracy was highest for mnemonics/memory strategies ($M = .93$) and individual difference/contextual influences ($M = .87$), which did not differ from each other. Encoding/retrieval factors ($M = .78$) and episodic memory phenomenon ($M = .75$) were next; both were significantly less than the first two rubrics but did not differ from each other. Memory organization/systems ($M = .43$) was significantly lower than all other rubrics. The Time of Testing $\times$ Topical Rubric interaction effect was significant, $F(4,\ 76) = 2.55$, $p = 0.05$. Follow-up one-way ANOVAs revealed that the age difference was significant only for encoding/retrieval factors. These results replicate Reese et al. (2000), who found the same pattern of mean differences for topical rubrics. Regarding age effects, Reese et al. found that older adults were more accurate than younger adults on three rubrics (episodic memory phenomenon, encoding/retrieval factors, and mnemonics/memory

strategies). In this study, mean age differences favored the old for these same rubrics, but the difference was significant for encoding/retrieval factors only.

We conducted a 2×5 mixed MANOVA with age as a between group variable and topical rubric (pathological: types of abnormal deficits, identification of abnormal deficits, mental health conditions and memory, physical health conditions and memory, adult dementia/AD) as a repeated measures factor. The age main effect was significant, $F(1, 81) = 15.51$, $p < 0.001$, favoring the older adults who were more accurate ($M = .82$) than the younger adults ($M = .71$). The topical rubric main effect was significant, $F(4, 78) = 25.56$, $p < 0.001$. Response accuracy was highest for types of abnormal deficits ($M = .91$). Physical health conditions affecting memory ($M = .83$), and adult dementia/AD ($M = .82$) were both significantly less than the first rubric, but did not differ from each other. Next were mental health conditions and memory ($M = .66$) and identification of abnormal deficits ($M = .62$), which did not differ from each other, but both were significantly lower than all other rubrics. The Time of Testing $\times$ Topical Rubric interaction effect was significant, $F(4, 78) = 2.78$, $p = 0.03$. Follow-up one-way ANOVAs confirmed that significant age differences favoring the older adults occurred for identification of abnormal deficits, mental health conditions and memory, and physical health conditions and memory. This aspect of the data replicates Reese et al. (2000) for the analysis of pathological memory aging items, with the identical pattern of significant age effects for the same three rubrics.

Item Analysis

We conducted an item analysis to identify the specific questions that younger and older adults answered DK to most often. For expository convenience, we report the five items with the highest DK endorsement for each age group. The proportions correct, incorrect, and "don't know" for each item, organized by topical rubric for younger and older adults, appear in Table 7.

For younger adults, questions showing the largest proportion of DK responses were Q7, Q24, Q8, Q15, and Q11. Means, in order, were .59, .49, .35, .29, and .27. Four of the five are pathological items. Q7, under Physical Health Conditions Affecting Memory, pertains to the adverse effects of cardiovascular medications on memory. Q24, under Mnemonics/Memory Strategies, refers to the history of modern day memory improvement methods. Q8, under Mental Health Conditions Affecting Memory, taps the similarity in symptoms seen with intense grief and early AD. Q15, under Adult Dementia/AD, pertains to the increased probability of AD in the oldest-old. Q11, under Mental

TABLE 7 Mean Proportion Correct, Incorrect, and "Don't Know" Responses per Item by Age and Topical Rubric in Experiment 3

	Younger adults			Older adults		
Topical rubric	Correct	Incorrect	DK	Correct	Incorrect	DK
Normal memory aging items						
Memory organization/ systems						
Item 3	.39	.49	.12	.61	.34	.05
Item 10	.31	.55	.14	.22	.68	.10
Item 20	.41	.45	.14	.29	.59	.12
Mean	.37	.50	.14	.37	.54	.09
Episodic memory phenomena						
Item 1	.90	.08	.02	.90	.07	.02
Item 6	.20	.55	.24	.27	.54	.20
Item 17	.76	.16	.08	.90	.10	.00
Mean	.62	.27	.12	.69	.24	.07
Encoding/retrieval factors						
Item 2	.22	.69	.08	.61	.37	.02
Item 13	.82	.12	.06	.98	.02	.00
Item 14	.76	.08	.16	.83	.07	.10
Mean	.60	.30	.10	.80	.15	.04
Mnemonics/memory strategies						
Item 24	.49	.02	.49	.54	.02	.44
Item 27	.71	.14	.14	.88	.05	.07
Mean	.60	.08	.32	.71	.04	.26
Individual difference/ contextual influences						
Item 16	.57	.20	.22	.93	.07	.00
Item 21	.82	.06	.12	.95	.00	.05
Item 23	.71	.14	.14	.61	.24	.15
Mean	.70	.14	.16	.83	.11	.07
Pathological memory aging items						
Types of abnormal deficits						
Item 5	.73	.18	.08	.78	.10	.12
Item 25	.86	.08	.06	.83	.12	.05
Item 26	.86	.02	.12	1.0	.00	.00
Mean	.82	.10	.09	.87	.07	.06
Identification of abnormal deficits						
Item 9	.69	.06	.24	.90	.05	.05
Item 12	.18	.76	.06	.37	.51	.12
Item 19	.45	.33	.22	.63	.27	.10
Mean	.44	.38	.18	.63	.28	.09

(*Continued*)

TABLE 7 (*Continued*)

	Younger adults			Older adults		
Topical rubric	Correct	Incorrect	DK	Correct	Incorrect	DK
Mental health conditions & memory						
Item 8	.49	.16	.35	.83	.15	.02
Item 11	.29	.45	.27	.63	.32	.05
Mean	.39	.31	.31	.73	.23	.04
Physical conditions & memory						
Item 4	.43	.43	.14	.88	.07	.05
Item 7	.33	.08	.59	.59	.22	.20
Item 28	.82	.00	.18	.93	.00	.07
Mean	.52	.17	.31	.80	.10	.11
Adult dementia/AD						
Item 15	.27	.45	.29	.32	.51	.17
Item 18	.96	.04	.00	.98	.00	.02
Item 22	.88	.02	.10	.98	.02	.00
Mean	.70	.17	.13	.76	.18	.07

Health Conditions Affecting Memory, refers to memory complaints and early AD.

For older adults, the items showing the largest proportion of DK responses were Q24, Q6, Q7, Q15, and Q23. Means, in order, were .44, .20, .20, .17, and .15. Half are normal and half are pathological items. Q24, under Mnemonics/Memory Strategies, taps the history of modern day memory improvement methods. Q6, under Episodic Memory Phenomenon, refers to the preserved, event-based prospective memory performance of older adults, compared to retrospective memory deficits. Q7, under Physical Health Conditions Affecting Memory, pertains to the adverse effects of cardiovascular medications on memory. Q15, under Adult Dementia/AD, taps the increased probability of AD in the oldest-old. Q23, under Individual Difference/Contextual Influences, taps the role of education, occupation, and verbal skills in memory.

GENERAL DISCUSSION

Increased Sensitivity of The KMAQ-DK

Experiment 1 demonstrated that college students answered more items correctly with the KMAQ-DK compared to the original KMAQ.

Interestingly, the increased sensitivity of the KMAQ-DK was more readily apparent for pathological, compared to normal, memory aging items. To be precise, college students were more likely to answer DK for pathological compared to normal items in Experiment 1, implying that they are less certain about their knowledge of pathological memory aging. The DK response option, then, may be more appealing to college students for pathological compared to normal memory aging items.

Alternatively, college students' answers for normal memory aging items may be more strongly influenced by stereotypical views of cognitive competence in late life than are their answers to pathological items. Although stereotypes of aging were not specifically addressed in the present research, the finding that younger adults endorsed DK less often, yet also answered fewer normal items correctly overall compared to pathological items is consistent with the idea that their knowledge of memory aging may be affected by misperceptions and stereotypes of aging more so than actual knowledge of memory change, but more research is needed. Identifying areas of uncertainty or misinformation about memory aging in college students is an important consideration for educators, having implications for the design of educational materials and programs that could be implemented in college and university settings. For example, dissemination of accurate information about memory aging could serve to counteract stereotypes that may result in negative interpersonal interactions between younger and older adults, such as patronizing talk.

Effects of Instruction on Memory Aging Issues

Fewer DK responses were made at posttest compared to pretest in Experiment 2, confirming the sensitivity of the KMAQ-DK to instruction. Interestingly, time of testing interacted with question type due to the significant reduction in DK responses from pre- to post test for pathological items, but not for normal items. Item analyses further revealed that four of the five items showing the largest reduction in DK responses from pre- to post test pertained to pathological memory aging. Thus, college students appeared more assured in their answers for pathological memory aging items after instruction, implying that pathological memory aging items may be more amenable to change with instruction than may be the case with normal memory aging items.

Analyses of proportion correct confirmed that response accuracy improved from pre- to post test, as expected, providing further confirmation of the sensitivity of the KMAQ-DK to instruction. More pathological items were answered correctly compared to normal memory aging items, replicating the same outcome in Experiment 1.

The analyses by topical rubric provided further insight into the specific areas of the KMAQ-DK that were most likely to improve with instruction. Analyses of proportion correct by topical rubric indicated that for normal memory aging items, significant pre- to post test improvement occurred for the items under memory organization/systems, and items related to encoding/retrieval factors. Pre- to post test performance was equivalent for items related to episodic memory phenomenon, mnemonics/memory strategies, and individual difference/contextual influences on memory. For the pathological memory aging items, gains in accuracy from pre- to post test occurred for items related to the identification of abnormal deficits and physical health conditions affecting memory. Performance did not differ from pre- to post test for items related to types of abnormal deficits, mental health conditions affecting memory, and adult dementia/AD.

Adult Age Differences In Knowledge of Memory Aging

Experiment 3 demonstrated that younger adults answered DK more often than older adults. This result is understandable, insofar as older adults generally have more knowledge of memory aging based on their own personal experience than do younger adults. Age also interacted with question type. This interaction occurred because the mean age difference in DK responses was larger for pathological compared to normal memory aging items (see Fig. 1). Item analyses revealed that there was very little overlap in the ranking of items answered DK for the two age groups. Q24, which pertains to the history of modern day memory improvement techniques, was the one item where younger and older adults showed similar levels of DK, proportions correct, and proportions incorrect.

The analyses of proportion correct confirmed that older adults were more accurate than younger adults, as expected. Both age groups answered more pathological items correctly compared to normal items, replicating Reese et al. (2000). Analyses of proportion correct by topical rubric largely replicated Reese et al. (2000), confirming the reliability and generality of their earlier findings. For normal memory aging items, older adults were more accurate than younger adults only on items related to encoding/retrieval factors. Both age groups performed comparably on items related to memory organization/systems, episodic memory phenomenon, mnemonics/memory strategies, and individual difference/contextual influences on memory. For the pathological memory aging items, older adults were more accurate than younger adults on items related to the identification of abnormal deficits, mental health conditions affecting memory, and physical

health conditions affecting memory. The age groups did not differ on items related to types of abnormal deficits or adult dementia/AD.

In closing, these studies have shown that the KMAQ-DK provides a sensitive assessment of memory knowledge, and therefore appears to be a useful tool in differentiating accurate knowledge of normal memory changes and pathological memory deficits in later life. An important direction for future research is to develop educational materials that target specific aspects of memory aging where accurate content knowledge is lacking, which would be most helpful for older persons as well as the general public (e.g., Commissaris, Ponds, Verhey, Jolles, Damoiseaux, & Kok, 1995).

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