

The Assessment of General Knowledge Online: A cross-cultural study using two platforms.

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Abstract

Participants from three countries completed a General Knowledge Test online with a total and subscale scores. There were predicted and significant sex and country effect. Those who scored were older people who took longer over the test, were more likely to use the internet to get answers and rated GK as important to themselves

Introduction

This paper is about the measurement of general knowledge online. It is concerned with what people do when being tested on line, as well as gender and cultural differences in general knowledge scores.

Measuring GK on Line

Over the past decade there has been a significant increase in the use of online assessment particularly of attitudes and beliefs. There are a number of different platforms that can be used with different advantages and disadvantages. A central concern for those using data from online sources is accuracy as well as representativeness (Buhrmester, Kwang & Gosling, 2011). One issue concerns the extent to which people are erratic, careless or simply responding randomly (Furnham, Hyde & Trickey, 2015). The problems associated with all self-report data namely dissimulation and self-awareness in personality and attitudinal research remain

However the problem is considered much more serious when doing any sort of ability testing which is always timed. The major issue concerns cheating in various ways: being clear about who is taking the test and how they could possibly cheat in other ways (Arnold, 2016). There may other issues like familiarity with computers and general use of the internet. Time taken in tests has proved an interesting indicator of respondent personality (Furnham et al. 1998, 2013).

In this study we tested general knowledge online using two different platforms and three population groups. We used a well-known test so that we might try to replicate results obtained in a more traditional testing environment.

We asked participants various questions after they completed the test: How important general knowledge was to them; how upset they would be with a poor score in a general knowledge test; whether they used the internet to answer any questions. We were particularly interested in the latter question and whether those who admitted to using the internet attained a higher score and took longer to complete the task. We hypothesized that completion time would be significantly positively associated with GK scores (H1); that those who used the internet while doing the test would score higher (H2); that older participants would score higher (H3) and that those who believed a good grasp of GK was important to them would score higher (H4)

In this study we chose to measure Gc with a measure of GK we had used in previous studies to see whether we could replicate the results so testing the efficacy of online testing

General Knowledge as a component of Crystallized Intelligence.

The measurement of Crystallized Intelligence (Gc) often includes tests of vocabulary and General Knowledge (GK). The domain of GK as a central component of intelligence, and a reliable metric of it, remains controversial in the literature (Chamorro-Premuzic, Furnham & Ackerman, 2006b). Thus while the Wechsler Adult Intelligence Test (Wechsler, 1981) has an *Information* sub-scale, which is similar to a GK test; the Stanford-Binet (Terman & Merrill, 1960) does not. However, the relationship between GK and intelligence has been reasonably well documented, as early as Vernon's (1950, 1969) work on scholastic and educational ability.

One test of GK that is increasing in use is the 216-item (and the shorter 72 item) test developed by Irwing, Cammock and Lynn (2001). It has a total score and six subscale scores. The GK test possesses good psychometric qualities and is up to date; and a shortened 72-item GK test with comparable qualities has been used by Furnham & Chamorro-Premuzic (2005). Recent research using the GK test has also demonstrated the logical and statistical connections of GK with intelligence.

A study by Chamorro-Premuzic, Furnham and Ackerman has demonstrated that GK is positively correlated with IQ ($r = .46$) and with abstract reasoning ($r = .37$), accounting for 26% of the variance in GK (2006b). Furthermore, this demonstrates GK is more strongly related to gc rather than gf; and thus provides support for the earlier conceptualization of GK as a sub-domain of gc. These results have been fairly consistent between studies, demonstrating that GK is moderately correlated with general intelligence ($r = .30-.62$) (Furnham & Chamorro-Premuzic, 2006). Kyollonen and Christal (1990) have also demonstrated that GK is more strongly related to gc than gf; with gf accounting for around 10% of the variance in GK; while general intelligence, a combination of gf and gc, accounts for as much as 33% of the variance in GK (Furnham & Chamorro-Premuzic, 2006).

Despite some research demonstrating a connection between GK and various personality traits (Batey, Furnham & Safiullina, 2010), such as Openness (Ackerman et al., 2001); evidence suggests that when IQ and other intellectual abilities are accounted for, personality traits possess little predictive validity for GK (Chamorro-Premuzic, Furnham & Ackerman, 2006b).

Correlates of GK;

Sex: There have been a number of sex difference in general knowledge using Irwing and Lynn's measure in different countries and with different populations but mainly school children and students (Allik et al., 1999; Lynn & Irwing, 2002; Lynn et al. 2002, 2004, 2009; Zarevski et al, 2014). They have all shown very similar results namely that males outperform females by a surprising large margin (d around .5). These differences occur for the overall score and most, but not all of the subscale scores: where males outperform females on all subscales except

knowledge of Fashion. A recent Austrian high school study (N=1088) with a meta-analysis confirmed the fact that males scored significantly higher than females but suggested the sex effect was of small to medium size.

Therefore it was predicted that males would have a significantly higher total scores than females in all sample (H5) and that Males would score significantly higher on Science (H6) and Sport (H7) but lower on Fashion (H8)

Estimated and Actual Intelligence: Self-estimated intelligence (SEI) is a topic of considerable current interest (Kaufman, 2012). This area has received various important reviews (Freund & Kasten, 2012). It should be noted that in all these studies intelligence is entirely and only about self-estimated intelligence, not about actual, psychometrically-tested intelligence. Where the two have been correlated the results show that overall people are poor at estimating their intelligence score with correlations typically between $r=.2$ and $r=.4$ (Furnham, 2001).

These studies have yielded various consistent findings. *First*, males of all ages and backgrounds tend to estimate their (overall) general intelligence about 5 to 15 IQ points higher than do females. Always those estimates are above average and usually around one standard deviation above the norm. *Second*, the correlation between self-estimated and test generated IQ is positive and low in the range of $r=.2$ to $r=.5$ suggesting that you cannot use test scores as proxy for actually scores. Finally it was predicted that SEI would be significantly correlated with total and subscale GK scores (H9)

Method

Participants

Amazon Mechanical Turk (MTurk) was used to collect data from participants. Data sourced from this online platform has been shown to be of high quality compared to other online and offline data collection methods (Buhrmester, Kwang & Gosling, 2011). For this study, two MTurk samples were collected; one consisting of participants from India, and the other consisting of participants from the USA. Additionally, a sample of UK participants was collected using Prolific Academic, a European online platform similar to MTurk.

Data cleansing (see Procedure) reduced the N to 270: 167 males (aged 33.29yrs, $SD=9.18$) and 103 females (aged 34.97yrs, $SD=10.07$). In all there were 101 participants from India, 97 from the UK and 72 from the USA. The American were significantly older than the British or Indians (36.99 vs 32.69 vs 32.94: ($F(2, 269)=4.78$, $p<.01$))

Measures

The General Knowledge Test (Irwing et al., 2001) is a 72 open-answer item questionnaire (Batey, Chamorro-Premuzic & Furnham, 2009); consisting of 6 different topic areas assessed by 12 questions each; including Literature, General Science, Medicine, Games, Fashion, and Finance. Most studies gave people 20 minutes for the task though because people either do or so not know the answer, complete all they know in 10 to 15 minutes. The GKT has been used as proxy measure for intelligence; and its scores correlate between $r=.4-.6$ with measures of general intelligence; as well as being up to date and possessing good psychometric properties (Furnham & Chamorro-Premuzic, 2006).

In addition to the General Knowledge Test and demographic measures, questions were asked regarding the participants' father's education and occupation. They were also asked:

How important is the grasp general knowledge is to you (1=Very to 5 Not at all)
How upset you would be with a poor score in a general knowledge test (1=Very to 5 Not at all)
Whether they used the internet to answer any questions (1=Yes, No=2)
Their perceived IQ (using the standard Bell Curve)

Procedure

We advertised on both platforms with similar instructions. We told people it was a general knowledge test and that they usually had to type in one or two word answers. We explained it was an academic study and that the data were anonymous. We asked people to answer as many questions as they could in 20 minutes.

We started off trying to get 150 people from each country. Missing data restricted this to 421 participants. On average people spent 17.84 minutes completing the test. However we also examined how long each participant had spent doing the test and found 16.1% of the sample had spent less than 5 minutes and in total 30.8% had spent less than 10 minutes at the task. These people were all removed from the total sample leaving an N of 270.

Results

Insert table 1 here

Preliminary Analysis:

1. *Completion Time:* This was correlated with the Total General Knowledge score as well as six dimensions. Four correlations were significant indicating those who took longer did better: Total ($r=.18$), Literature ($r=.36$), Science ($r=.21$) Health ($r=.15$). Completion time was also significantly correlated with how important GK was to them ($r=-.21$) indicating that they worked faster if it was less important. Completion time was also correlated with how upset they said they would be with a poor score ($r=-.27$) showing that people worked faster if they did not care much. There was a significant correlation with internet use ($r=.22$) showing that those who admitted to using the internet received lower scores. The correlation between self-estimated intelligence and completion times was not significant
2. *Country differences:* Anova results revealed three differences. Compared to the Indians and Britons, the American cared less about having a good grasp of GK ($F(2,269)=7.02$, $p<.001$), and said they would be less upset with a poor score ($F(2,269)=4.56$, $p<.01$). In estimating their own IQ, the Indians gave significantly lower estimates (102.08) compared to the British (110.28) and Americans (112.49) ($F(2,266)=9.11$, $p<.001$).
3. *Internet use:* In all 35 people admitted to using the internet while completing the test. Various Anovas yielded the following significant results: Compared those who did not, those who admitted using the internet: Had higher GK Total ($F(1,290)=10.56$), Literature ($F(1,290)=11.63$), and Fashion ($F(1,290)=11.95$), scores. They are had longer completion times (35.32 vs 22.29 minutes ($F(1,290)=14.20$), and claimed they would be more upset if they got a poor score ($F(1,290)=5.60$)

Gender and Country Differences

A two-way (Gender x Country) ANOVA was computed across the Total GK score and the six Facet score

Insert Table 2 here

Table 2 shows there were four significant effects for country. The Indians scored highest for Literature and Science, the Americans for Sports and the British for fashion. There were three main effects for gender: Females scored higher than males for Health and Fashion but lower

for Science. There was only one significant interaction which was due to British females scoring particularly highly for Fashion

Predicting GK scores

A series of seven stepwise regressions was then computed with the total GK score and the seven facets as the criterion scores. The first step was completion time, the second age and sex; the third internet use; and the fourth ratings of grasp, upset and self-estimated IQ.

Insert Table 3 here

Table 3 shows the results of the final step in the regression. In all five of the variables were significant predictor of the Total score and accounted for just over a fifth of the variance. It showed that older people who took longer to do these test, used the internet, thought having a good grasp of the internet and gave themselves higher self-estimated intelligence scores got a higher total GK score..

Looking across the results for the six regressions onto the speciality topic some patterns are clear. For ever regression self-estimated IQ was a significant and often the highest predictor. Completion time was significant in three regressions, and age in four. Gender was significant in three with females doing better in the Fashion, but worse in the Science and Finance questions. The regression with Literature score as the criterion variable accounted for most of the variance (28%) and Finance the least (05%)

Discussion

We believe that this was one of this first studies to attempt to measure General Knowledge online. Many of our hypotheses were confirmed: completion time, using the internet, age, ratings of the importance of GK as well as self-rated intelligence were all related to overall GK.

There was no overall sex effect as predicted but some difference on the facet scores. We also found some country differences

Interestingly, Internet Use was a predictor of Total GK, literature and fashion scores. Likewise, Completion Time was also a predictor of total GK, literature, science and health scores. Overall, those who had used the internet, and took longer to complete to the GK test; obtained higher scores overall. As this clearly indicates that these individuals did not possess the necessary knowledge to answer the questions appropriately, the veracity of these results as representative of actual GK must be seriously questioned. Furthermore, it is likely that many participants did not concede the use of the internet when they had

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Table 2

General Linear Model results for the effect of Country, Gender and the interaction upon general knowledge and sub-scale scores

	India (<i>M, SD</i>)		UK (<i>M, SD</i>)		USA (<i>M, SD</i>)		Country <i>F</i> (2,333)	Gender <i>F</i> (1,333)	C & <i>GF</i> (2, 333)
	Male	Female	Male	Female	Male	Female			
Total	31.46 (13.47)	34.50 (11.28)	31.20 (11.12)	32.72 (8.64)	33.13 (19.21)	29.24 (9.98)	1.09	0.01	2.23
Literature	6.51 (4.43)	7.92 (3.36)	5.91 (3.24)	5.91 (2.69)	5.18 (3.67)	4.91 (3.03)	8.49***	0.54	1.57
Science	7.65 (2.55)	7.92 (2.17)	7.45 (2.35)	6.55 (2.00)	7.24 (2.86)	6.12 (2.51)	5.55**	4.27*	2.41
Health	7.98 (3.27)	8.97 (2.88)	7.86 (2.83)	9.06 (2.46)	8.79 (2.62)	9.15 (2.30)	0.21	4.71*	0.76
Sports	3.63 (3.49)	4.42 (2.52)	6.34 (2.80)	5.70 (2.39)	7.24 (2.48)	6.91 (4.37)	18.46***	0.20	1.79
Fashion	3.00 (3.34)	3.58 (3.32)	3.19 (3.03)	5.48 (3.40)	3.00 (2.17)	3.35 (2.67)	5.62**	6.51*	3.06*
Finance	6.32 (2.89)	6.11 (2.70)	6.42 (2.77)	5.73 (2.24)	6.42 (2.54)	5.71 (2.65)	0.56	3.72*	0.53

*** $p < .001$ ** $p < .005$ * $p < .05$

Table 1.
Correlation Matrix of all variables

	1	2	3	4	5	6	7
1. Total Score	-						
2. Completion Time	.39**	-					
3. GK Grasp	-.28**	-.20**	-				
4. GK Upset	-.16**	-.26**	.46**	-			
5. Internet Use (0 = No, 1 = Yes)	.23**	.27**	-.08	-.15**	-		
6. Age	.21**	.01	-.03	-.03	-.10	-	
7. Gender (1 = Male, 2 = Female)	.01	.07	.00	.00	-.01	.02	-
*** $p < .001$							
** $p < .005$							
* $p < .05$							

Table 3.

Regression summaries for total general knowledge and sub-scale scores from predictor variables

	Total Score		Literature		Science		Health		Sports		Fashion		Finance	
<i>Predictor Variables</i>	<i>Beta</i>	<i>t</i>	<i>Beta</i>	<i>t</i>	<i>Beta</i>	<i>t</i>	<i>Beta</i>	<i>t</i>	<i>Beta</i>	<i>t</i>	<i>Beta</i>	<i>t</i>	<i>Beta</i>	<i>t</i>
Completion Time	.16*	2.57	.32***	5.56	.21***	3.27	.13*	2.06	-.09	-1.43	.04	0.63	.05	0.71
Age	.16*	2.76	.03	0.58	.06	1.01	.16*	2.69	.21***	3.57	.23***	3.95	.21***	3.46
Gender	-.01	-0.18	.01	0.16	-.14*	-2.35	.13*	2.34	.01	0.21	.14*	2.57	-.12*	-2.10
Internet Use	.15*	2.56	.13*	2.34	.02	0.40	-.01	-0.17	.01	0.22	.19***	3.24	.02	0.24
GK Grasp	-.23***	-3.64	-.27***	-4.51	-.08	-1.15	-.13	-1.94	-.11	-1.66	-.19**	-2.96	-.11	-1.69
GK Upset	-.01	-0.10	-.02	-0.36	-.03	-0.41	-.05	-0.81	.11	1.66	-.02	-0.36	-.01	-0.16
Perceived IQ	.24***	4.27	.16**	3.00	.23***	3.83	.25***	4.17	.22***	3.62	.18**	3.16	.17*	2.77
Step 1	F(1,266) = 13.52***, Adj. R ² = .05		F(1,266) = 52.44***, Adj. R ² = .16		F(1,266) = 11.10***, Adj. R ² = .04		F(1,266) = 5.70*, Adj. R ² = .02		F(1,266) = 3.94*, Adj. R ² = .01		F(1,266) = 4.62*, Adj. R ² = .01		F(1,266) = .51, Adj. R ² = .00	
Step 2	F(3,266) = 8.27***, Adj. R ² = .08		F(3,266) = 17.79***, Adj. R ² = .16		F(3,266) = 6.52***, Adj. R ² = .06		F(3,266) = 8.28***, Adj. R ² = .08		F(3,266) = 7.55***, Adj. R ² = .07		F(3,266) = 9.80***, Adj. R ² = .09		F(3,266) = 6.85***, Adj. R ² = .06	
Step 3	F(4,266) = 7.66***, Adj. R ² = .09		F(4,266) = 14.72***, Adj. R ² = .17		F(4,266) = 4.91***, Adj. R ² = .06		F(4,266) = 6.20***, Adj. R ² = .07		F(4,266) = 5.64***, Adj. R ² = .07		F(4,266) = 9.98***, Adj. R ² = .12		F(4,266) = 5.13***, Adj. R ² = .06	
Step 4	F(7,266) = 10.87***, Adj. R ² = .21		F(7,266) = 15.45***, Adj. R ² = .28		F(7,266) = 5.68***, Adj. R ² = .11		F(7,266) = 7.84***, Adj. R ² = .15		F(7,266) = 6.23***, Adj. R ² = .12		F(7,266) = 9.85***, Adj. R ² = .19		F(7,266) = 4.96***, Adj. R ² = .09	

*** $p < .001$ ** $p < .005$ * $p < .05$

Table 4.

General Linear Model results for the effect of Country, Gender and the interaction upon general knowledge and sub-scale scores

	India (<i>M, SD</i>)		UK (<i>M, SD</i>)		USA (<i>M, SD</i>)		Country <i>F</i> (2,333)	Gender <i>F</i> (1,333)	C & GF(2, 333)
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Science	7.65 (2.55)	7.92 (2.17)	7.45 (2.35)	6.55 (2.00)	7.24 (2.86)	6.12 (2.51)	5.55**	4.27*	2.41
Health	7.98 (3.27)	8.97 (2.88)	7.86 (2.83)	9.06 (2.46)	8.79 (2.62)	9.15 (2.30)	.21	4.71*	.76
Sports	3.63 (3.49)	4.42 (2.52)	6.34 (2.80)	5.70 (2.39)	7.24 (2.48)	6.91 (4.37)	18.46***	.20	1.79
Fashion	3.00 (3.34)	3.58 (3.32)	3.19 (3.03)	5.48 (3.40)	3.00 (2.17)	3.35 (2.67)	5.62**	6.51*	3.06*
Finance	6.32 (2.89)	6.11 (2.70)	6.42 (2.77)	5.73 (2.24)	6.42 (2.54)	5.71 (2.65)	.56	3.72	.53

*** $p < .001$ ** $p < .005$ * $p < .05$

