

Science Literacy Among University Students: A Cross-Cultural Comparison of Students in Eau Claire, WI and Students in Stirling, UK

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Background

In scientific circles, evolutionary theory ranks alongside gravity and electricity in its caliber as a theoretical notion verging on fact (Dawkins, 2009). However, in international comparisons, the U.S.A. ranks essentially at the top in belief in God or a supreme being. In fact, U.S. citizens score lower on knowledge and acceptance of evolution than do citizens in 32 European countries and Japan (Miller, Scott, & Okamoto, 2006). Rates of science literacy in America are also relatively low by absolute standards, hovering between 25-30%. However, Americans score *higher* in science literacy than do citizens in many other countries (Hobson, 2008), including the same countries that outperform them in knowledge and acceptance of evolution. Scientists have suggested that required exposure to science courses in American colleges is responsible for the relative U.S. advantage in science literacy (Hobson, 2008). At the same time, other scientists have argued that strong religious belief in America is responsible for the U.S. deficit in understanding evolution (e.g., Dawkins, 2006). Poor understanding of evolutionary principles and hostile attitudes toward evolution are tied to dangerous educational movements (Miller, 1999). And, deficits in scientific literacy (despite any relative cross-country advantage) are disconcerting because knowledge in the fields of genetics and biology is expanding rapidly. A basic level of understanding of genetics and biological processes is increasingly relevant for understanding current technologies, making informed medical decisions, and ensuring appropriate use of genetic information (Haga, 2006). Scientific literacy is also important for understanding probabilistic information and distinguishing between correlation and causation (for instance, in the case of the purported link between thimerosal in vaccines and ASD). While levels of overall religiosity in the US have remained high, the UK has experienced a significant erosion of belief in God (Gill, Hadaway, & Marler, 1998). If religiosity is linked to deficits in science literacy, we would predict that the UK university would have higher levels of science literacy – especially evolutionary – and lower levels of belief in God overall. However, most US colleges have General Education requirements, which expect students to take science courses they may have otherwise avoided or skipped. If these courses promote higher science literacy, we would predict that the US university would have higher levels of science literacy. This study aims to test these competing predictions.

Method

Overview
With help from faculty and staff from the University of Wisconsin-Eau Claire and the University of Stirling in Scotland, UK (see Acknowledgements), we collected responses from a representative sample of undergraduate students (71 undergraduate students from UW-Eau Claire, and 178 students from the University of Stirling) representing majors in the social sciences and pre-professionals. All participants completed measures of scientific reasoning and scientific knowledge, as well as measures of religiosity, subscription to religious fallacies, and both moral objections to and distrust of science. Our items were taken from various sources, primarily from Hawley et al. (2010) and Miller (1998).

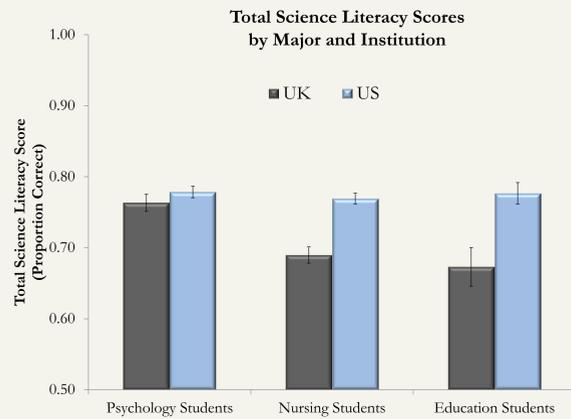
Belief in God
Our measure of religiosity included a single question on an 11-point response scale (e.g., “To what extent do you believe in God or a supreme being?”) that ranged from *not at all* to *completely*. For purposes of analysis we created a categorical variable to highlight the differences between strong (8-10), moderate (3-7), and weak or no belief (0-2).

Religious fallacies and objections
Three subscales evaluated religious fallacies and objections. One subscale assessed participants’ moral objections to evolution (2 items, $\alpha = .62$; e.g., “People who accept evolution as fact are immoral”), another assessed young earth creationist beliefs (4 items, $\alpha = .90$; e.g., “Adam and Eve from Genesis are the universal ancestors of the entire human race”), and a third subscale assessed subscription to intelligent design fallacies (6 items, $\alpha = .80$; e.g., “There is scientific evidence that humans were created by a supreme being or intelligent designer”). All attitude items were completed with an 11-point response scale that ranged from *disagree strongly* to *agree strongly*.

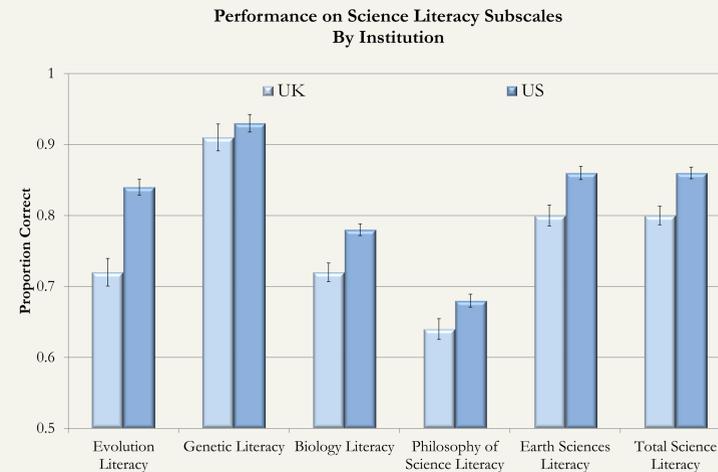
Distrust of Science
Six items assessed participants’ distrust of science ($\alpha = .73$; e.g., “Science and technology have created a world that is full of risks for people” and “Science and technology make our way of life change too fast”). Items on this scale were also completed with an 11-point response scale ranging from *disagree strongly* to *agree strongly*.

Science Literacy
Participants completed a total of 55 closed-ended items to assess their knowledge and understanding of science. Questions spanned topics including genetics (14 items), “The genetic information encoded in DNA molecules provides instruction for assembling fats and lipids”; biology (5 items), “The oxygen we breathe comes from plants”; evolutionary theory (15 items), “Increased genetic variability makes a population more resistant to extinction”; earth sciences (10 items), “The continents on which we live have been moving their locations for millions of years and will continue to move in the future”; philosophy of science (6 items), “Good theories give rise to testable predictions”. We report subtopic performance as well total science literacy.

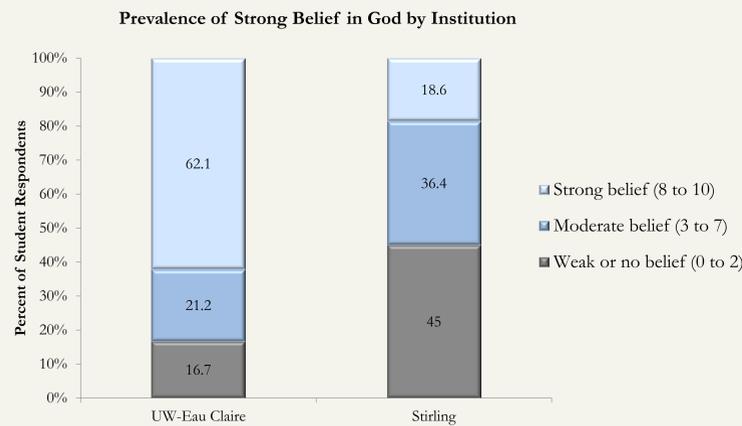
Results



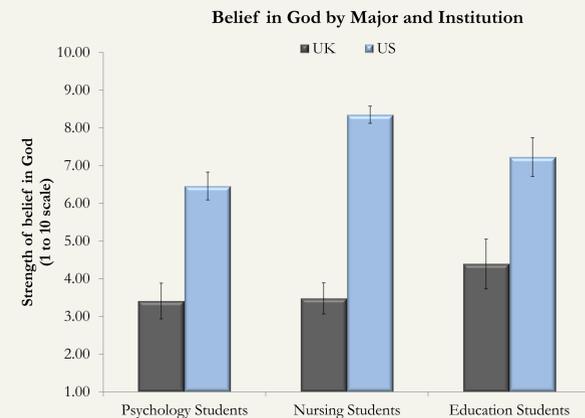
Overall science literacy was higher among UW-Eau Claire students than among University of Stirling students, $t(251.02) = -4.32, p < .001$. Among the areas of study we had access to, Eau Claire nursing and education students performed higher on than their Stirling counterparts ($ps < .002$).



Among the subscales, Eau Claire students performed higher on than Stirling students on all subscales except the *Genetic Literacy* subscale. (all $ps < .001$).



Our US and UK samples were drastically different when it came to reporting belief in God. UW-Eau Claire students ($M = 7.14, SD = 3.39$) reported an overall higher belief in God than did University of Stirling students ($M = 3.62, SD = 3.41$), $t(952) = -12.48, p < .001$.



UW-Eau Claire students reported higher belief in God (or a supreme being) than University of Stirling students did within each major, with psychology students reporting the overall lowest belief ($M = 4.68, SD = 1.51$).

Belief in God as a Correlate of Religious Fallacies and Objections to Evolution, Distrust of Science, and Science Literacy

	Belief in God (0 to 10)	Distrust of Science and Technology (0 to 10)	Belief that Science is Harmful (0 to 10)	Moral Objections to Evolution (0 to 10)	Intelligent Design Beliefs (0 to 10)	Young Earth Creationism Beliefs (0 to 10)	Evolution Literacy (0 to 100%)	Science Literacy (0 to 100%)
Belief in God	-----	-.15	-.11	-.13	.02	.19*	.12	-.27**
Distrust of Science and Technology	.16**	-----	.36**	.61**	.06	.54**	-.05	-.25**
Belief that Science is Harmful	-.05	.12	-----	.25	.33**	.28**	-.25**	-.47**
Moral Objections to Evolution	.19**	.04	-.02	-----	.41*	.41*	-.54	-.39
Intelligent Design Beliefs	.37**	.18**	.32**	.07	-----	.21*	-.13	-.41**
Young Earth Creationism Beliefs	.40**	.53**	.22**	.4**	.37**	-----	-.06	.04
Evolution Literacy	-.36**	-.12	-.06	.03	-.30**	-.15*	-----	.16
Science Literacy	-.29**	-.28**	-.16*	-.08	-.32**	-.19**	.31**	-----
Overall Mean (SD)	4.77 (2.03)	3.60 (2.11)	4.05 (2.07)	2.18 (1.31)	2.47 (2.23)	3.78 (1.94)	79.83 (21.33)	84.37 (14.40)

Note. Correlation coefficients for University of Stirling students are above the main diagonal and shaded red; coefficients for UW-Eau Claire students are below the main diagonal and shaded blue.

* $p < .05$, ** $p < .01$

Discussion

Overall, our findings suggest that science literacy levels in the University of Wisconsin-Eau Claire college student sample, as a composite and in various domains, tend to be slightly above the levels found at the University of Stirling, UK. This finding was unexpected considering Dawkins’ proposal that religious beliefs inhibit acquisition of knowledge of evolution, because the reported levels of belief were much higher among students in the United States sample. Among the areas of study we had access to, Eau Claire nursing and education students performed higher on than their Stirling counterparts. In comparison, the differences in science literacy among psychology students between countries were not statistically significant. Overall levels of belief in God were drastically different by institution. The average reported level in the University of Wisconsin-Eau Claire sample was nearly twice that of the average reported by students in the UK. Levels of belief in God also varied across majors, with nursing students in the US sample reporting the highest levels of belief. Similar to previous findings on the US sample, levels of evolutionary literacy are relatively low. While both samples scored lowest on this measure, the US sample still scored significantly higher than the UK sample – again despite the drastically higher levels of belief. Our data do not allow us to determine whether these results would be found in the overall populations of both countries, however the University of Wisconsin-Eau Claire and the University of Stirling were chosen in this comparison primarily because of their similarities in student population, offered areas of study, entrance requirements, and researchers’ access to students of similar majors to use in this comparison. One limitation we faced in this study was the lack of access to a comparison of students in the math and sciences. This makes it difficult to determine whether the findings, though significant, would be found across all majors. Historically, America has been a very religious country; most polls suggest approximately 90% of the population believes in God. The United Kingdom on the other hand hovers around 40%, and our findings mirror these statistics. Given the findings from this study, further investigation into the systematic differences of required coursework across majors in the United States and United Kingdom could shed light on whether students enrolled in U.S. universities with GE requirements may actually have a slight advantage when it comes to science literacy.

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