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Teaching intelligence

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ABSTRACT

This article encourages psychologists to teach intelligence at different levels of the undergraduate curriculum and at postgraduate level. In addition, intelligence should be 'taught' to psychologists more broadly, to relevant professionals, and to the public. I give examples of attempts to teach to all these audiences, and the materials I prepared to do so. Some problems with, and tips for teaching intelligence are given.

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1. Introduction

It was being taught the psychology of intelligence differences that attracted me to psychology in the first place. In the late 1970s, early on in my medical undergraduate curriculum at the University of Edinburgh, the clinical psychologist Ralph McGuire was given the unenviable job of teaching medical students part of their social sciences course. Amongst these lectures were some lectures on psychology, most of which I have forgotten. However, for me, the lecture room lit up when I started hearing about the scientific study of individual differences. This included both intelligence and personality differences, and this combining of the two is much more common amongst psychologists in the United Kingdom than it is in the USA, probably as encouraged by H.J. Eysenck. The interest in intelligence differences that I picked up so early in my undergraduate degree course was able to be followed up. The University of Edinburgh offered medical students the opportunity to leave the medical course for a year and obtain an honours degree in one of a number of subjects. For the first time in 1979 they offered Psychology as an option. I took it. My psychology undergraduate education, therefore, amounts to all of about eight months, not counting the few lectures in the medical undergraduate curriculum. Moreover, in the academic year in which I studied for my psychology degree I took no classes in intelligence. However, my undergraduate dissertation

supervisor was Chris Brand, and the many, many hours I spent with him whilst discussing that dissertation was an extensive education in intelligence differences. Moreover, my undergraduate dissertation with Chris led to our jointly publishing it and a wider review in Eysenck's *A Model for Intelligence* (Brand & Deary, 1982). Following that introduction I returned to medical school and medical practice. However, within two years of completing my medical degree I was back in the Psychology Department and at the University of Edinburgh as a lecturer in Psychology. My chosen topic for research was human intelligence differences, and I am still doing that. Also, amongst the many things I have taught since then are human intelligence differences.

As I shall describe below, I have taught intelligence at all levels from public outreach to postgraduate level. Each time I have decided to teach a particular audience, I have found that I was dissatisfied with the materials that were to hand for teaching. This is also the case in personality differences, where I also decided that the book had to be written because there was no appropriate book available (Matthews, Deary, & Whiteman, 2009). Indeed, that book grew out of an overview article in which Gerry Matthews and I were trying to tell psychologists that traits were the scientific approach to personality (Deary & Matthews, 1993). The aim of the current article is to encourage others to teach intelligence through all levels of psychology and more broadly. Also, it gives a guide to the topics that I think are important within intelligence, and also those that attract and

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retain students; this retaining is important, because they usually have a choice about which courses they opt for, other than at the most introductory levels.

2. Courses taught

I currently teach intelligence in the first of four undergraduate years of the Psychology degree at the University of Edinburgh in Scotland. Until recently, I also taught intelligence at the fourth year level which, in Scotland, is the most senior undergraduate level. I also currently teach aspects of intelligence to MSc students. These latter students are taking a one year course following their undergraduate degree, and a proportion of them go on to study for a PhD. I give regular public lectures on intelligence, some to wider groups of academics, some to other professionals, some to older-age groups, some to schoolchildren, and some to the general public.

2.1. Psychology 1: the first undergraduate year

My current teaching involves introducing over 300 first-year undergraduates to intelligence differences. This occurs in a first-year course that covers the broad range of psychological topics that is to be found in most introductory psychology textbooks. The book currently used at the University of Edinburgh is that by Schacter, Gilbert, and Wegner (2012). The students come from a number of backgrounds, many of whom will have little or weak scientific backgrounds. Therefore, attracting interest and retaining it—and not alienating people who have little by way of statistical skills or biological knowledge—is most important. My lecture series includes both personality and intelligence, and I place the intelligence lectures at the end of that series. My lectures are the first that they receive in the introductory psychology course, making them the students' first lectures in their university career.

The materials I use for this course are the chapter in the Schacter et al. (2012) book and my own *Intelligence: a very short introduction* (Deary, 2001a). I originally drafted the chapter for the Schacter et al. book, though it has changed a bit now. There are many introductory psychology textbooks, and most of them have a chapter on intelligence. I think the one in Schacter et al. is one of the better ones. The topics I cover in the first-year lectures are: the history of intelligence testing (Galton, Binet, Spearman); the spread of IQ testing internationally; models of human intelligence differences (Spearman, Thurstone, Guildford, Cattell, Carroll, Gardner); tests of intelligence (especially the Stanford–Binet and the Wechsler Adult Intelligence Scales); applications of intelligence in medicine, education, and occupation; genes, environment and neurobiology and intelligence; and sex differences.

The course is assessed amongst other topics with a multiple choice examination. This introduction is intended to be interesting and attractive, so that it retains students' interests in the topic when they progress to more senior years and have a choice about which courses they will take. All my Powerpoint slides for the lectures are provided as a pdf handout online for the students in advance of the lectures. Despite the size of the class I ask them questions, and I encourage them to ask me questions, which they

frequently do. Before the lectures start, they take a personality test. Before the intelligence lectures they do an in-class exercise in which they rate their intelligence scores (having been shown the population distribution) and those of their mother and father. I analyse these and present these in the next lecture. My lectures on individual differences have been typically rated at or about the top in the first year. Edinburgh typically has a reasonably large number of students who do thereafter develop an advanced interest in individual differences, which is helped by the relatively large number of staff who work in this area.

2.2. Psychology 4: the most senior undergraduate year

At the most senior undergraduate level there is time to teach in more detail. Most of the teaching is done using material from recent research papers, and students are expected to be able to read these and critically evaluate them. The course I taught on intelligence until recently was ten hours in length; five 2-hour sessions. The topics I chose to form this course were: how many types of intelligence are there?; the ageing of intelligence; speed of information processing in intelligence; biological approaches to intelligence differences; and a discussion topic. The discussion topic varied from year to year, and included cognitive epidemiology (intelligence, health and death) and the Flynn Effect. The first four sessions were taught as lectures, with regular, within-lecture discussion. The discussion topic was presented by the students (from chosen papers) and then debated by them. The assessment of the course was by a written examination at the end of the year.

I had realised that there was no book that covered this level of intelligence discussion and it was this that led to my writing *Looking Down on Human Intelligence* (Deary, 2000), which was in fact an expansion of the course. However, as that book developed, it became more appropriate for postgraduates than for undergraduates. The fourth year course clearly has general topics, and also reflects my own research interests. The ethos of these senior undergraduate courses at the University of Edinburgh is such that they should be relatively close to the researchers' interests. The fourth year class was typically one of the larger ones in the department, with around 40–50 students, meaning that many students signed up and it was popular. This was despite its having techniques such as structural equation modelling used in the lectures and also epidemiological techniques. Therefore, there can be a 'popular' advanced intelligence course at the undergraduate level. *Looking down...* won the British Psychological Society's Book Award and the lecture that I gave at the award gave me the chance to teach psychologists more generally about intelligence differences (Deary, 2003).

2.3. Postgraduate MSc course

As Director of the Medical Research Council-administered Centre for Cognitive Ageing and Cognitive Epidemiology at the University of Edinburgh I run a ten-week course of that name, each of which has a two-hour lecture session. I open this by teaching the MSc students about cognition and its ageing. This is especially challenging, because the entrants to our course, whereas they do involve some people with an

individual differences background, largely involve people with a neuropsychology or neuroscience background. These latter two groups lack the psychometric background that our senior undergraduates would have gained and, therefore, the introduction has to be somewhat gentler than for our senior undergraduates. My ethos in all my teaching is to get people interested, to get them on board, and then to develop their interest and expertise. In introducing cognitive ageing I deal with the following topics: pathological versus normal cognitive ageing; the importance of cognitive ageing; domains of cognitive functions; the hierarchy of cognitive functions, including *g*; cross-sectional studies of ageing; longitudinal studies of cognitive ageing; limitations of cross-sectional and longitudinal studies of cognitive ageing; between people differences in cognitive ageing; determinants of cognitive ageing; and theoretical constructs including cognitive reserve and the common cause theory of cognitive ageing.

The benefits of even a short introduction at the MSc level mean that we do manage to attract some people to study for PhDs using an individual differences approach to intelligence. Often, these will be individuals who go on to study genetics or brain imaging, and will develop psychometric capabilities as they go along. In the UK the three years of PhD study after the MSc year are generally not taught, and so teaching of intelligence at this stage is by PhD supervision meetings in which research plans, progress and problems are discussed.

2.4. The public

I think it is important that people outside the psychology student body learn about intelligence differences. This might be because it annoys me how much poor information is out there about my topic; and in part, it might be because I like the positive feedback I get from having a good set of intelligence research stories to tell. Good stories include Carroll's massive data collation exercise, the discovery of the Flynn effect, the re-testing of the participants in the Scottish Mental Surveys after several decades, and the work on separated twins. These are a few examples of how one can start with a personal story and use that as a lead into a description of data, analyses and important findings. I try to make about half of my talks each year public talks. I have given talks on intelligence to Science Festivals (e.g., Cheltenham and Edinburgh), to Cafés Scientifique, to Skeptics societies, to schools, to the British Psychological Society children's lectures in London and Edinburgh, and to too many older-age groups to recall. Thus, I have had to take on and counter some ingrained ideas about human abilities. And I have had to warm up audiences in challenging places. At Cafés Scientifique one has to speak without slides in a café/bar area. Following my Science Festival lecture in Cheltenham I had to, barker-like, sit in the middle of a bookshop and start attracting a crowd to hear me talk about intelligence; there was no prior announcement, and no guaranteed crowd. In all of these instances I rely on—updated versions of and additions to—the stories that were told in my *Intelligence: a very short introduction*. At Cafés Scientifique and Skeptics societies I have used a technique of focussing in on some top stories about intelligence. For these I allow myself one slide per story, and that slide must, as far as possible, be based on one large data set. I talk for 5 min on each story, and take five minutes of questions, and then move

to the next one. My topics/stories are (where 'it' refers to intelligence): It's one thing, it's a few, and it is many; It matters for education; It matters for social mobility; It matters for survival; It's partly genetic, partly environmental, and there are twist(s); Bigger brains tend to be smarter; There are sex differences, but not the obvious ones; It doesn't all go when it goes; Not everyone ages the same; It has gone up with time, or has it? This approach seems to work OK. Judge for yourself; one of my talks in this style is here...

<http://www.youtube.com/watch?v=MGnCYdr7dYE&list=UUvXjmARhUOdnV5hQ1JBPjCA&index=3>.

3. Articles on intelligence differences

During my career as an academic in psychology at the University of Edinburgh, I have written many accounts of intelligence that have not been empirical studies. These include short pieces, longer overviews and reviews, and books. On looking over the list and thinking about their audiences and rationales, I realise that almost all of them were motivated by frustration; the frustration that there was an interesting story about intelligence that was either being mis-told or not told at all. The accounts range all the way from teaching intelligent lay people and professionals generally to research-level specialist accounts. I strongly encourage others to 'teach' in these ways and I shall describe some of the pieces I have done to try and do this. From this list I have deliberately omitted the many book chapters I have written on aspects of intelligence. Mostly, this is because they tend to be for the intelligence or individual differences community of researchers, and also because I judge that peer-reviewed articles have a better imprimatur than book chapters.

In the various books and articles described below, there were choices to be made about which intelligence topics to teach. To an extent, these are tailored to the audience, but there are also some core topics. I would summarise the broad core topics as: the characteristics of the phenotype, the causes of intelligence differences, and the consequences of intelligence differences. With regard to the phenotype, I have always considered it important to explain the hierarchical model of intelligence differences with *g* at the pinnacle, and also to cover the stability of intelligence, and the changes with age. With regard to the causes of intelligence, the consideration of nature and nurture and the biological foundations of intelligence differences in brain structure and function are key. The main consequences of intelligence differences that I cover are in education, health, and occupation.

First, my books. The first I should deal with is my *Intelligence: a very short introduction* (Deary, 2001a). This came just after I had written *Looking down on human intelligence* (Deary, 2000). Oxford University Press told me they had this new series of short books, and asked me to consider doing one on intelligence following my long academic monograph. I wasn't keen, and originally refused. They persisted. I gave in. I recall the way I decided to write this. I chose the topics to be similar to my fourth-year course, which was also similar to my *Looking down on human intelligence*. Although it was for the public, I decided that I would deal directly with data; more specifically, with particular datasets. I wanted to tell good, strong stories. I wanted people to see the empirical foundations from which we argued about intelligence differences and made our judgements about

the findings within intelligence. I wrote the first draft of the book mostly without any materials in front of me, which I resorted to in order to check numbers and other facts. I am glad that I was persuaded to do it. To date it has sold over 30,000 copies and been translated into 9 non-English languages and I still think—although it would be nice to update it—that it does a fairly good job of introducing the sometimes-misunderstood and controversial topic of intelligence in an even-handed way.

By contrast with the very short introduction, *Looking down on human intelligence* was a summing of reductionist attempts to examine the intelligence, and some long commentaries on these attempts. Like all such books, its factual basis withers as years of new findings supersede what one has covered. However, I hope the commentaries still have force and there are useful lessons there for intelligence researchers. However, one must be frank in admitting that *Intelligence: a very short introduction* has a far larger readership, and it is likely stay relevant for longer. My other book on intelligence (Deary, Whalley, & Starr, 2009) was *A lifetime of intelligence: follow up studies of the Scottish Mental Surveys of 1932 and 1947*. This was a 'record' of the first ten years of our research on the Scottish Mental Surveys and our follow-ups of them. It has a different teaching function. It was born out of the frustration of people not knowing the range of materials we had published in our follow-up studies. It proved to be a good way of organising the several dozens of papers that had been spread through the psychological, medical, social science and general science literature. Moreover, my account of the history of the Scottish Mental Surveys which is captured in the first chapter, is often used at our postgraduate level because we have many postgraduates involved in the Scottish Mental Survey follow-up studies.

I mentioned earlier that I had written the first draft of the Schacter et al. (2012) chapter on intelligence. This was an interesting process, with the publisher very keen that the book be not too different from other psychology introductory text books, yet also have some novel aspects. This means that it is heavily constrained in its materials. It covers important intelligence topics, although necessarily at a fairly superficial level.

Writing more broadly, for the educated lay person and wider professionals, I have found that I wanted to get across the main aspects of intelligence. This is what motivated for example, my short article for the *British Medical Journal* to teach doctors about intelligence (Deary, 1998), and also my longer historical piece in the *British Journal of Psychology* on the centenary of the discovery of *g* by Charles Spearman (Deary, 2001b) the intention of which was to teach psychologists broadly about intelligence differences. I also judge that it is important to take intelligence to those who would normally ignore it or even dislike it (the latter perhaps because they haven't had or taken the opportunity to learn about it). Therefore, I have written four articles over the years for *Trends in Cognitive Sciences*. This is normally a journal read by experimental/cognitive psychologists, and therefore it is a good setting in which to widen people's knowledge about intelligence differences, because they almost always ignore them. In 2001 I wrote two articles: one was a general introduction to psychometric approaches to intelligence (Deary, 2001c), and the companion one (Deary, 2001d) was an attempt to show how one might

bring together cognitive and experimental approaches to intelligence, which I also attempted elsewhere (Deary, 2005b). More recent articles covered genetic attempts to discover the genetic bases of cognition and cognitive ageing (Deary, Wright, Harris, Whalley, & Starr, 2004; Harris & Deary, 2011).

Cognitive psychologists are one audience that I am convinced would benefit from knowing more about intelligence differences. They are dedicated to offering a modal account of cognitive processes, yet the fact of large individual differences is likely to have implications for the general application of such models of cognition. Epidemiologists are another, and possibly an even more important one. Also in the tradition of teaching other professionals about psychology, I wrote a glossary on cognitive epidemiology for the *International Journal of Epidemiology* (Deary & Batty, 2007), the location also for my discussion on the various ways in which intelligence and education might be related (Deary & Johnson, 2010). These articles attempted to bring the basics of intelligence measurement and validity to epidemiologists. I have also attempted to bring intelligence and personality as important medical variables to professionals in medicine, psychology and science more broadly (Deary, 2005a, 2008; Deary, Weiss, & Batty, 2010). As I become more involved in research using intelligence as an epidemiological 'exposure' variable, I have worked with epidemiologists and realised that their statistical techniques and approaches are quite similar to those of differential psychologists. However, they do tend to be very environmentally oriented, and not necessarily initially open to the idea of stable intelligence traits when they first meet it. Therefore, they are ripe for teaching about intelligence and, in general, I have found them to be quite open to that. From the other side—and I think this is helped by my being trained in both medicine and psychology—I have tried to bring medical outcomes as a fertile source of outcome variables to individual differences psychologists (Deary, 2009, 2010).

A third audience I have thought could benefit more from learning about intelligence differences are geneticists. Therefore, using my judgement that it is better not to preach to the choir, my reviews of the work done on genetics and intelligence have been placed in genetics and not psychology journals (Deary, Johnson, & Houlihan, 2009; Deary, Spinath, & Bates, 2006). Alongside similar lines, I have tried to bring the psychology of intelligence differences to neuroscientists, first for *Trends in Neurosciences* (Deary & Caryl, 1997). More recently, we undertook an article for *Nature Reviews Neuroscience* to show to neuroscientists generally the recent discovery in the biology of intelligence, with a large emphasis on genetics and brain imaging (Deary, Penke, & Johnson, 2010). Again, this was taking it into a camp where people normally would not study intelligence differences.

Also, more broadly to psychologists, I decided to undertake one of the *Annual Review of Psychology* chapters and devote it to intelligence (Deary, 2012a). This tried to introduce people through some of the main discoveries over the last ten years in intelligence. This was a different kind of teaching. It was an attempt to show that what might be seen as a stale topic actually has some interesting new discoveries and areas of exploration. And, in a recent historical article, it was fun to rake through every issue of

the *American Journal of Psychology* to see how much it had covered intelligence differences (Deary, 2012b).

4. Problems in teaching intelligence

The material of intelligence is interesting, and there are many good stories to tell. I have tried to tell some of these at general and more specific levels. However, there are problems, and these go some way toward explaining why there are so few academics in intelligence, and so few undergraduate and postgraduate courses in intelligence. From the professional psychology side, the first is the dominance of cognitive psychology and neuropsychology. There is still a strong tendency for people to see individual differences as the ignorable error variance. There is still a tendency for people to study undergraduates as their subjects and to be interested only in working out the modal structure of intelligence. Therefore, one has to counter these tendencies. From the public side, a principal problem is the fact that people think they know about intelligence already. Also, there is misinformation about intelligence from those who tell only part of the story. My answer to that has been to take the public as close as possible to real data and let them see why one has come to certain conclusions.

I have avoided this until now, but there is a problem with psychometrics. There is no doubt that, to become efficient, students will have to take on at some point the psychometric methods that underpin the study of intelligence. Of course, this begins with correlation, and proceeds to the full psychometric panoply of principal components and factor analysis, structural equation modelling, classical test theory, items response theory, and so forth. One has to be careful, I think, to introduce these first at conceptual levels, because there is a widespread allergy amongst many psychology students to mathematical approaches and this can alienate people at an early level (one of my colleagues disagrees and thinks one should start with matrix algebra). Therefore, I find it interesting to see how books on intelligence actually deal with this. For example, I note the large difference between Mackintosh's (2011) good book on intelligence and Hunt's (2011) good book on intelligence: the latter has more technical psychometrics than the former though both managed to do a good job on teaching intelligence. My opinion about which is better is rather a fudge; there needs to be enough psychometrics so that the minority in the audience who would be drawn to this aspect can see that there is statistical rigour behind the data and findings, and there needs not to be so much that one alienates those who are less inclined to the multivariate statistics.

And that brings me to another problem with teaching intelligence: the lack of decent books. It is over ten years since I wrote *Intelligence: a very short introduction* to try to grab the public's interest on the topic without their being cornered by someone with a biased view. I was surprised to see it being used for undergraduate courses, though it seems to be so in some places. However, I already stated above, I think Mackintosh's and Hunt's books are both good introductions to intelligence. Beyond that there is not a large number of good, recent books, though Colin Cooper's (2010) more general book on individual differences has been a useful one also.

5. Tips on teaching intelligence

I think our topic of intelligence gives us a great head start on teaching it. It has a great, disputative history, but one must not be crushed by that. That is, one must be able to show how interesting the history is without being shackled by the debates and making it seem as if we are still locked in indecision because of them. The topic of intelligence provides us with a strong script. It has great characters and a good plot with lots of human interest; we should use all of these in our teaching. Gain people's interest and explain the data and findings. The topic has interesting personalities. The topic has great findings, often on large scales. The topic has very interesting individual studies. The topic keeps having new angles, such as the Flynn Effect and more recently with cognitive epidemiology.

We are fortunate that the topic is intrinsically interesting, the topic of population-level studies, and also very practically important. We find intelligence measurement in many places: in education, in occupation, in medicine, in ageing, and in large genetic consortia. More and more, we need people with expertise on intelligence in each of these settings. For example, it has been a surprise to me that, as the new genome-wide association consortia have gathered, there is a clear lack of expertise world-wide on this topic, and individual differences psychologists can make themselves useful here. Also, cognitive capability—the study of intelligence—is more and more widely used in the growing topic of ageing and in chronic illnesses. Therefore, in both cognitive ageing and cognitive epidemiology there is a lack of individuals who are trained in the psychometrics of intelligence, and yet whose expertise is needed.

6. Conclusion

From the general public, through professionals and psychologists general, to psychology students with a particular interest in intelligence and their development through to postgraduate study and independent research, we need to teach intelligence. It has been and is a Cinderella topic. The psychology of cognition is incorrectly dominated by the current fashion for cognitive psychology. Yet, the measurement and application of intelligence and its cognitive domains is practically very important for society in many different settings. We need a group of professionals who are expert in this. Beyond that, my teaching of intelligence over three decades has taught me that, introduced with enthusiasm and good, clear examples, intelligence can be an attractive topic and that we can obtain and retain people's interest in it. Lastly, I should mention the fact that intelligence is often seen as controversial. I must say that, in all my time teaching intelligence, I have not presented it in that way. I have had the fortune to teach intelligence to groups who have come with little prejudice about it, and they have mostly gone away, I hope, with similarly little prejudice. It is controversial if one wants it to be and if one approaches it in that way. However, it can be taught simply as an interesting topic with some great data and with the assurance that, if people take the time to know something about these data and think about what they mean, they will be the better off for it.

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