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Journalists, Numeracy and Cultural Capital

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Abstract

Journalists are tasked with holding power to account; often, that means evaluating and interpreting numbers. But anecdotally, journalists are ill at ease with figures. This shortcoming is worrying both in terms of the quality of news provided to the public, and the implications for informed democratic debate. This paper tests the assertion that journalism as a profession is numeracy-challenged through a small-scale study of the numeracy capabilities of journalism students. Some oft-cited reasons for these shortcomings are discussed, including the pressures of deadlines and the tyranny of the 24-hour news cycle, where the mantra of "never wrong for long" appears to justify a casual approach to getting numbers right. Then, drawing on the work of Pierre Bourdieu and his notion of "cultural capital," the under-appreciated role played by symbolic culture in journalists' attitude to figures is highlighted. Symbolic culture determines what is valued by a group or sub-group of people (such as journalists), and what it is acceptable to denigrate ("I'm no good at math!" spoken as a boast). Journalism culture, it is argued, is opposed to numeracy. Finally, it is argued that in addition to the worthwhile efforts to improve numeracy skills among journalists, the culture of journalism itself needs to be transformed. The novel suggestion is made that science and math students should be encouraged to enter the profession, which has traditionally been dominated by liberal arts students.

Keywords

numeracy, quantitative literacy, journalism, media, education, two cultures

Cover Page Footnote

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Introduction

Society counts on journalists; counts on us to make sense of the figures which lie at the heart of our world, from taxes and health outcomes to elections and sports results. But why are we journalists often considered weak when it comes to dealing with numbers? Colleagues at my institution recall asking undergraduate students what they thought of mathematics—many replied that it was a dislike of mathematics at school that led them to choose journalism as a degree subject in the first place. It is a view echoed in the 2014 advice to prospective students on the website of the University of Oregon's journalism department: "If you have your heart set on it, you can avoid math" (although, in fairness, the next sentence continues: "… should you take math? Of course you should!" The webpage has since changed). The consequences of poor numeracy skills among journalists are spelled out by Amelia Genis in her study examining the level of numerical competence among the profession in South Africa: "When they do use numbers, the numbers often do not make sense, either because they were not examined for discrepancies or plausibility, or because they were not put in context" (Genis 2001, 9).

On the surface, then, it would appear that journalists—among whom I still number myself—are unable or unwilling to engage with quantitative thinking to the extent that the exalted nature of their calling demands; in particular, doing justice to journalism's duty to reflect "the increasingly mathematical complexity of our society in its many quantitative, probabilistic, and dynamic facets" (Paulos 1996, 3). The issue is not merely of parochial interest to journalist educators and the authors of papers on numeracy and journalism; reporting on numbers can lead to significant interventions in public policy. Cohn and Cope (2012, 4) make the point that "the very way in which we journalists tell our readers and viewers about a … controversy can affect the outcome. [W]e have in effect become part of the regulatory apparatus." In his analysis of how U.S. news media reported on homelessness in the 1980s, Christopher Hewitt (1996, 445) observes that: "Much of today's political and social agenda is built on statistics that are unreliable or exaggerated, presented as though they were the product of careful scientific investigation … it might appear that neither the media nor policymakers are able to distinguish rubbish from real research."

It goes without saying that not all journalists struggle with numeracy, and we don't all do so in the same way—journalism is no more homogeneous a profession than any other. As an historical side note, it may come as a surprise that the 17th century proto-journalist Henry Care[1] wrote a brief guide to numeracy as part of his self-improvement manual, *The Tutor to True English* (Care 1687). Care's work covers the rudiments of arithmetic, including cross-multiplication (the so-called "Rule of Three"), but all presented in a practical,

[1] See Schwoerer 2004.

real-world context, as one would expect of a populist author. Care's example shows that even from the earliest days, it is neither self-evident nor inevitable that journalism and numeracy don't play well together—other factors must be at work. But to date, the evidence that we journalists struggle with numeracy is largely anecdotal. In their study into how journalists' perceived maths ability determines their efficacy, Curtin and Maier (2001, 732) point out that "quantitative studies are needed to confirm or deny the universality of the constructs [i.e., related to maths anxiety] that emerged from this research." One of the aims of this paper is to gather some data to test whether it is indeed the case that journalism students flounder with figures, and on the basis that the journalism students of today are the journalists of tomorrow, it is likely this weakness with numbers is therefore true of journalists. I will look at some of the common reasons why it may be the case that journalists are number-phobes before suggesting one of my own—the effect of cultural capital—and drawing the perhaps surprising conclusion that what is needed is not just to make journalists into quantitative thinkers, but also to make quantitative thinkers into journalists.

Study Project

Evaluating numeracy levels is a complex issue (e.g., Gillman 2006; Ranney et al. 2008; Boersma and Klyve 2013; Madison 2014), and it is not the purpose of the current study to engage with this task. Its more modest goal is to start to explore whether journalism students truly are numerically challenged by comparing their performance on a numeracy quiz with that of peers from a different discipline. Hence the study involved 72 first-year undergraduate (Level 4) students, of whom 32 studied journalism and 40 studied statistics. In each case, the entire year-group had been invited to take part, and students were given the option of whether they wished to participate or not; there were neither inducements to take part nor penalties for declining to take part. Of course, journalism students are not journalists (at least, not yet)—however, from experience at my institution, around two-fifths of journalism graduates do go into the profession. Since there is no magic wand which imbues graduates with numeracy skills once they start employment, it seems reasonable to suggest that journalism students who struggle with numeracy go on to become journalists who struggle with numeracy. *Forbes* columnist Dan Seligman noted: "After many years of observing media colleagues at work, I would say most of them were standing behind the door when quantitative skills were handed out" (Seligman 2002).

All students were given the same brief numeracy quiz comprising 10 questions; six questions were based on Ward et al. (2011),[2] and one was taken from Lipkus et al. (2001), this question having also been used in the study of

[2] The questions were either used unaltered, or modified to reflect UK units or terms. All questions reproduced with permission.

Ward et al. The remainder were devised by the current author—see the appendix for the list of questions and answers. Following the approach adopted by Ward et al., the rationale behind the type of questions selected was to draw them from everyday contexts and not to rely on any assumed contextual knowledge (Ward et al. 2011, 11). It was a pen-and-paper test, and students were allowed to use calculators but not allowed to access the Internet. They were given 10-15 mins to complete the test, which was carried out during breaks before or between timetabled sessions to make it seem less formal and hence less daunting. No preparation was necessary—the test was carried out immediately after students volunteered to take part. Options for the answers were a combination of multiple choice (with four options) and fill-in-the-blank. It is recognised that ‘maths anxiety’ can affect some students (Maier and Curtin 2004; Ward et al. 2011), so the test was labelled a “Numeracy Quiz.”

Students were also asked whether they had studied mainly science-based subjects (such as mathematics, physics or science) or arts-based subjects (such as English, history or media studies) at “A” level or equivalent (roughly equal to the U.S. SAT II). For those unfamiliar with the school system in England and Wales, compulsory education ends at age 16. By this age, students will have taken their GCSE examinations. Students intending to take a degree at university normally go on to study for the more advanced “A” level examinations from the age of 16-18, either at school or at sixth-form colleges. Many universities demand three passes at “A” level as a prerequisite for study at undergraduate level, although this requirement can vary. Students tend to specialise in science-based or arts-based “A” levels (say, pure and applied mathematics and physical science on the one hand; or history, English and politics on the other). There is no requirement for applicants wishing to study journalism to have an “A” level in a science-based subject (although a pass in GCSE mathematics is usually required). In consequence, it is typical for a journalism undergraduate to have studied no science or mathematics since the age of 16. Twenty-eight (87.5%) of the journalism students had taken subjects at “A” level which were exclusively or predominantly arts-based; three students (9.4%) had taken science-based subjects; and the remaining student had taken a mixture of both. Five journalism students had taken mathematics to “A” level or equivalent—one had a Grade B, one had Grade D, two had Grade E and one had Grade U. Among the statistics students, 32 of them (80%) had a predominantly science-based background; five (12.5%) had an arts-based background, and the remaining three (7.5%) had a mixture.

Figure 1 shows the percentage of students from each discipline who correctly answered each question. In general, the statistics students clearly outperformed the journalism students, as expected. The mean score for the journalism students was 7.78 with a standard deviation of 1.184, and the mean for the statistics students was 8.63 with a standard deviation of 1.102. The value for Welch’s *t*-test of equality of means was –3.098. Questions four and five are exceptions to the observation that statistics students did as well as or better than the journalism students. All journalism students correctly answered question four, whereas two statistics students gave the wrong answer. The error seems to be a slip in mental arithmetic, as both the statistics students who answered incorrectly gave the answer “2051” instead of “2061” (and two further statistics students initially wrote “2051” but crossed it out and then selected the correct answer —none of the journalism students did this).

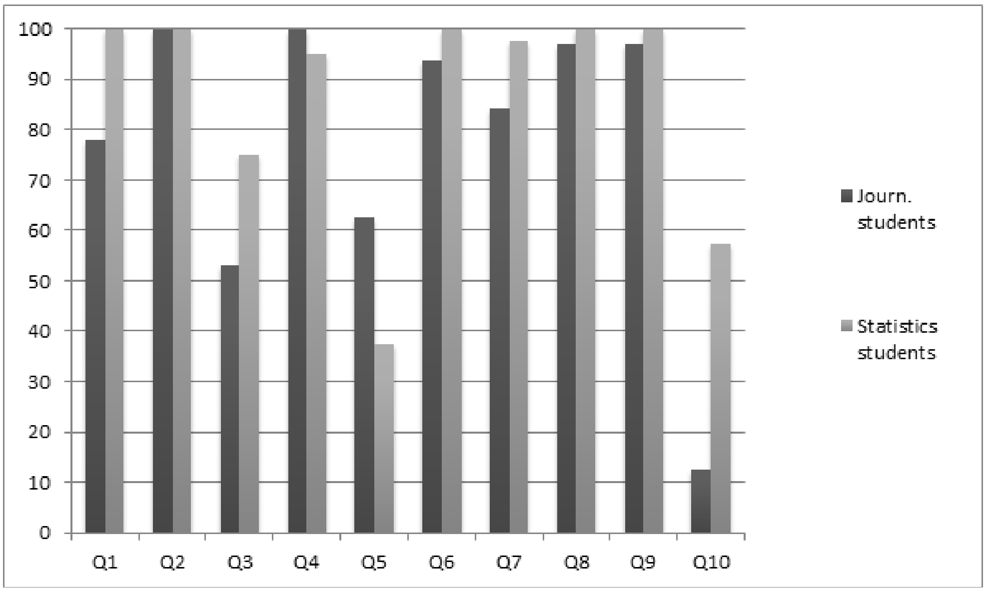

Figure 1. Percentage of students answering each question correctly

Question 5 proved to be more problematic. The correct answer was “2% in 10 years,” and the “Answer” field of this part of the question paper was left blank for the students to write in their responses. However, 22 (all but three) of the statistics students who got this item wrong had written simply “2%,” possibly because they took the “...in 10 years” part of the answer as going without saying. On subsequent re-examination of the source of this question, a discrepancy emerged. The question was initially drawn from Ward et al., who indeed give the answer as “2% in 10 years” (Ward et al. 2011, Appendix A). However, Ward et al. had in turn taken their question from the 2001 study of Lipkus et al., whose paper gives the answer as “2%” (Lipkus et al. 2001, 40). Because of this ambiguity, question 5 has been excluded from the analysis in Figure 2. The mean score for journalism students when Q5 is excluded was 7.16 (sd: 1.110), and that for the statistics students was 8.22 (0.881), with an associated Welch *t*-test of –4.436. If the study were to be repeated in the future, this question will have a gapped Answer field (“____% in _____ years”) to make it clearer what is required.

The largest variance is with Q10, where only four journalism students (12.5%) gave the correct answer, compared with 23 statistics students (57.5%). Among the journalism students, 11 students (34.4%) did not attempt to answer, while for the statistics students, only one student (2.5%) did not attempt an answer. This result is consistent with the view that the statistics

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students felt far more confident about attempting an answer. Interestingly, Q6 also involves percentages, although here the problem is cast in non-mathematical language—working out the tip on a restaurant bill. This question was answered correctly by 30 of the 32 journalism students (93.75%) and attempted by them all, which indicates that the journalism students have little difficulty with the *technique* of calculating percentages. It is, rather, the *language* used that appears to have defeated or at least deterred the journalism students, which supports the view of Curtin and Maier (2001, 720) that "perceived math ability, not actual ability, appears key to determining the extent that journalists work effectively with numbers."

The extent of the difference in performance between the two groups of students is vividly illustrated by Figure 2, which counts the students by the number of correct answers they gave (Q5 is excluded, for reasons given above).

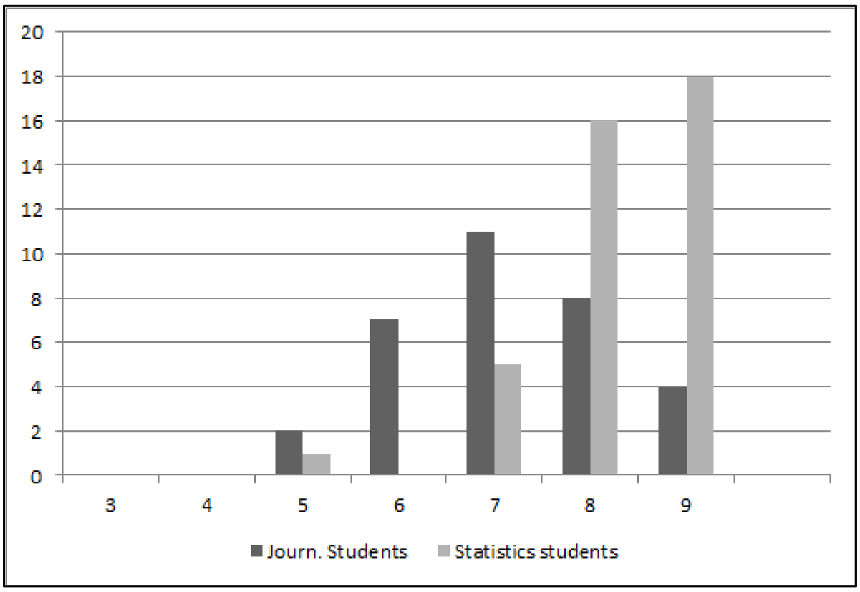

Figure 2. The two frequency distributions of correct answers (Q5 excluded). Number of students is along the *y*-axis; number of correct answers along the *x*-axis.

So what types of mistakes did the journalism students make? The first question asked for half of one-third, which all the *statistics* students answered correctly. Eight of the journalism students answered "two-sixths," doubling denominator and numerator rather than just the denominator. Q3 proved more challenging, requiring students to evaluate 20% of 80%. Thirteen journalism students got it wrong (giving three different answers between them), while another simply wrote: "Don't know." For Q7 (where the statistics students again all answered correctly), there were four "Don't knows" and one incorrect answer. The "Don't knows" were out in force for Q10, with 11 of the journalism students (34.4%) either writing "Don't know" or leaving the answer field blank. Yet none of the statistics students failed to give an answer to any question. The fact that so many of the journalism students failed to attempt an answer to Q10 is something to which we will return.

Factors at Work

There is evidence here that journalism students are poorer than statistics students in dealing with numeracy questions. Perhaps that is no surprise—after all, statistics students ought to be strong at dealing with numbers. But given the overall performance of the journalism students and the fact that the questions they struggled with were so basic, it isn't stretching the point to characterise their performance as weak in absolute terms—and there is no reason to suppose they magically become more adept at dealing with numbers when they enter the workplace. So granted that we journalists falter over figures, why might this be? I want to list a few of the more widely recognised reasons before suggesting one of my own, which isn't so commonly cited.

It's widely held that the six main factors are pressure of time; limited or unreliable sources; lack of knowledge or interest; lack of space; mistakes introduced during the editing process; and errors in transmission.[3] Of these, time pressure is the most significant and can lead to many of the others. It is not just the reporter in the field who toils under the burden of imminent deadlines (a burden made even more onerous with the rise of 24-hour news[4] and digital-first publication strategies)—the news editor who insists on a topical angle, the sub-editor who knocks out a quick headline, and the executive who creates a "write-off" (a summary designed to pique interest in the full version of an article inside the newspaper) for the front page are equally pressed for time and equally prone to distort, misinterpret or over-sell an otherwise perfectly crafted news story. As an example, a reporter at one of my former newspapers wrote an accurate account of the annual soccer match between politicians and journalists which took place during a Labour party conference in Liverpool. Unfortunately, the headline read: "Journalists beat Labour XII in football match,"[5] which suggests that the sub-editor who wrote it either didn't know that 'XII' is '12' in Roman numerals, or that there are only 11 players in a soccer team. Such mistakes are by no means rare; Maier's three-month audit of a daily newspaper found "mathematical errors to be fairly prevalent—a new type of numerical error was identified about every other day" (Maier 2002: 507).

Staffing levels, too, play a part in why numerical errors creep in. The Pew Research Center quotes figures from the American Society of News Editors' Newsroom Employment Census showing that "after falling 11% in 2008 and

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[3] Such errors were listed by the *Columbia Journalism Review* in its analysis of the five main reasons why journalists get the numbers wrong (CJR 2009).

[4] The very title of Rosenberg and Feldman's 2008 polemic against 24-hour news culture aptly sums up the problem: *No Time to Think*.

[5] http://www.liverpoolecho.co.uk/news/liverpool-news/labour-party-conference-liverpool---3366183 (accessed January 8 2016)

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6% in 2012, overall newsroom employment was down 3% in 2013—the most recent year for which figures are available—to 36,700" (Barthel 2015). Francois Nel estimated that between 2001 and 2010, "the UK's mainstream journalism corps has shrunk by between a quarter and a third" (Nel 2010). Not only does fewer reporting staff mean that an individual reporter needs to work harder, but some reporters now write their own headlines as well, meaning that the traditional "second pair of eyes" associated with the sub-editor are no longer brought to bear on the story.

In addition to such innocent blunders, the editorial stance of a news publication may affect its handling of data. In the run-up to an election, a staunchly right-wing newspaper may present poll data in a radically different way to a rival left-wing newspaper—it is barely worth mentioning the numerous ways in which data can be deliberately massaged, misrepresented or omitted (e.g., Reichmann 1964; Huff 1991; Best 2012). A noteworthy recent example was the use of poll data by UK tabloid *The Sun* purporting to show that one-in-five British Muslims supported jihadi terror groups such as ISIS. The widespread criticism of the way the newspaper treated the data led the polling organisation which carried out the survey to distance itself from the report, saying it did not "endorse or support the way in which this poll's findings have been presented by the *Sun* newspaper" (*Guardian* 2005). Finally, some argue that the very form of news—its need for narrative, drama and novelty—leads journalists systemically to simplify and to de-contextualise their stories, which in turn means less emphasis is placed on verifiable data and more on opinion (Davies 2009). While this criticism may be true of some tabloids, it is too large a generalisation to cover the majority of quality newspapers, and does not explain how most newspapers do manage to get it right most of the time (Maier 2002).

All the above, however, are well recognised as causes of error in stories which involve numeracy. In exploring why journalism students (and we journalists) get it wrong, I want to put forward the view that one of the reasons is "cultural" (in a sense to be explained), as opposed to purely technical. This cultural explanation hasn't received much attention in the past and leads to a strategy for combatting the problem that differs from that traditionally proffered. Previous studies have laid the blame for poor numeracy skills on the fact that journalists are bad at sums and so have argued that the solution is to train them to do sums better; those who lay the blame at the door of staffing levels argue for more staff. But this paper's emphasis on cultural limitations leads to a recommendation that, if not novel, is certainly unfamiliar—namely, that journalism schools ought to draw their intake from the ranks of the science, maths and technology (STEM) students as well as from the traditional pool of English and creative writing students (in fairness, Curtin and Maier 2001, 733, do propose "making math a requisite skill for a degree in journalism," and Madison 2012 persuasively argues the case for teaching STEM students how to write). So in what sense is 'culture' involved here, and how does it manifest itself in the notion of cultural capital?

Culture and Cultural Capital

It is a claim of this paper that a theoretical model of cultural capital can go some way towards explaining the reluctance of some journalists to engage with numbers. One reason for considering the possibility that cultural factors are at work is that the level of mathematical ability required to report most news stories is minimal, and so what frequently seems to be lacking is cultural confidence, not a grounding in higher mathematics. There are many cultures—cultures of style, of language and of belief. Two of the dominant cultures of the modern world were famously contrasted by C. P. Snow in his influential 1956 essay "The Two Cultures." Snow coined, or at least popularised, the term "the two cultures" both in this *New Statesman* article and in a lecture three years later in order to highlight the polarisation of society between the arts and the sciences (Snow 1959). While the debate has developed in sophistication over the intervening decades (Brockman 1996; Bernstein 1993; Orrill 2007[6]; Leavis 2013), Snow's underlying contention remains valid—lack of understanding between scientists and non-scientists is damaging to the wider intellectual development of society. As Bernard Madison (2012, 2) has observed, while Snow's view "may be an exaggeration of what we have today" regarding the breach between scientists and humanists, "we are not far away." The culture of the man of science valorises analysis, rigour and quantitative thinking, while that of the man of the arts values instinct, spontaneity and creativity. However much members of each group may differ from each other, they are bound by a common element which radically separates them from the members of the other group: "Without thinking about it, they respond alike. That is what culture means" (Snow 1959, 6).

The underlying principles of the theory of cultural capital originated in the re-examination of subjectivity beginning in the mid-17th century, whose starting point can be identified as the 1637 publication of Descartes' *Discourse on Method* (Devlin 1997). In its modern form, the concept of cultural capital took shape in the writings of Pierre Bourdieu, whose influential essay Symbolic Power, originally published in 1977 and translated two years later, is most immediately indebted to Max Weber (Weber 2013) and Ernst Cassirer (Cassirer 1955). Bourdieu (1979, 81) writes:

> The dominant fractions, whose power is based on economic and political capital, seek to impose the legitimacy of their domination either through their own symbolic production (discourse, writings, etc.) [...] The dominated fraction always tends to set cultural capital—to which it owes its position—at the top of the hierarchy of the principles of hierarchization.

Hence cultural capital plays a role structurally analogous in the symbolic realm to that played by economic capital in the material realm. 'Capital' in both senses can be put to work by elites to produce surplus value—a form of

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[6] Orrill pithily sums up what is at stake in the formulation that "opposition to quantification has become deeply-seated in the heritage of humanism" (Orrill 2007: 56).

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"wealth" based on currency or prestige which accrues from occupying a dominant position in the economic structure or symbolic superstructure. For instance, DiMaggio's study into the impact of cultural capital on one group within society (U.S. high school students) found that "cultural capital has an impact on high school grades that is highly significant" (DiMaggio 1982, 199).

In their review of the ways in which the notion of cultural capital has mutated and been transformed since Bourdieu's characterisation, Lamont and Lareau (1988, 156) coin their own definition: cultural capital, they aver, constitutes "institutionalized … high status cultural signals (attitudes, preferences, formal knowledge, behaviors, goods and credentials) used for social and cultural exclusion." But it is noteworthy that what is lost in this modification of Bourdieu's formulation is precisely the link with Marx's analysis of "capital," without which the material effects generated by cultural capital become inexplicable. Where lies the power to delimit the "inside" and the "outside"—to include or exclude—if not from a position of structural mastery? It is not clear how the basis for such power could be understood once divorced from the material conditions of symbolic reproduction—what Lamont and Lareau (1988, 161) dismissively characterise as "the French context" of cultural capital.

Nevertheless, Lamont and Lareau (1988, 158) make the valuable point that acquisition and display of cultural capital is not in the main a conscious activity: "Bourdieu thinks that most signals are sent *unconsciously* because they are learned through family socialization, and incorporated as dispositions, or *habitus*, or are the unintended classificatory results of cultural codes" (emphasis in original). Hence the display of cultural capital is not an act of deliberate one-upmanship or showing off, in spite of Veblen's view to the contrary (Veblen 1912, cited in Lamont and Lareau). Rather, it is "the way things are done," that which comes "naturally" or "goes without saying." When applied to the context of the present study, cultural capital provides a mechanism for explaining variance in the performance of the two groups of students who agreed to take part in a short quantitative literacy test. For one group, it "goes without saying" that numeracy is nothing more than applied common sense; for the other, Bob Orrill's phrase, "quantitatively oblivious," comes to mind (Orrill 2007, 49).

The materialist implications of the apparently idealist conception of cultural capital is suggested by Cassirer's (1955, 80) observation that: "… the content of the concept of culture cannot be detached from the fundamental forms and direction of human activity"—culture actively shapes, and is shaped by, our activity in the world (labour). Numeracy is an ontological stance grounded in our interaction with the world (a stance towards being), not a species of knowledge. This characterisation problematises its inculcation, as Curtin and Maier (2001, 722) acknowledge: "How journalists can be trained to avoid math errors and to increase math literacy … remains understudied."

While cultural capital may seem an alien concept within numeracy studies, it is related to the more familiar theme of "disposition," which occurs regularly, for instance, in definitions of quantitative literacy (e.g., Madison and Dingman 2010; Mayes et al. 2013; Wismath and Worrall 2015). They are related by what Bourdieu calls "habitus," the idea that "individuals' predispositions, assumptions, judgments and behaviors are the result of a long-term process of socialization" (Benson and Neveu 2005, 3). Cultural capital, as part of an individual's habitus, stresses the dynamical nature of socialisation—while a "disposition" may be (statically) embodied or inherited, cultural capital is (dynamically) accumulated, spent and transformed in much the same way as economic capital. So while the above discussion could be recast in terms of dispositions, cultural capital is preferred in this paper because it suggests both an etiology and a way forward.

Discussion

As noted above, there were significant differences in the performance of the two groups of students in the numeracy test, yet none of the questions required any deep mathematical facility or knowledge. Notably, those questions which were framed in non-mathematical language (such as Q2 or Q6) show no difference in performance; however, the final question, which explicitly requires students to calculate a percentage increase, showed the greatest difference. This performance is consistent with the hypothesis that one factor at work is the effect of cultural capital, the unreflexive manner of Being-in-the-World. The suggestion is that mathematical knowledge or facility per se is not fully determinative of students' performance in the numeracy quiz, and that this notion applies to the workplace, too. In the case of the quiz, performance partly depends on which group the student is in: statistics students happily tackle Q10 even though they may get the answer wrong; journalism students shy away from engaging with it. This behaviour is consistent with the view that confidence between the two groups plays an important role, with the journalists showing more trepidation about risking an answer. The behavior is a trait of culture rather than knowledge or ability, and it is the sense in which Bourdieu's cultural norms and expectations get to work, silently determining what is thinkable and hence what is achievable—delimiting the possibility of providing answers, thinking a problem through or challenging the imagination. Broadening my argument, if this thesis is true of journalism students, then it is likely to be true of journalists, a view supported by the perspectives of working journalists interviewed by Curtin and Maier (2001, 734): "I don't know what the answer [to improving maths confidence among journalists] is, but we've got to change the culture."

Of course, this argument does not preclude other factors, such as those discussed earlier, having an effect too. Even so, and regardless of the underlying reasons, the parlous state of numeracy among some of its practitioners suggested by this data is worrying for journalism. Society needs reporters and production journalists who can analyse, interrogate and challenge quantitative information. While it remains true that journalists can always draw on the expertise of data specialists or statisticians on an ad hoc basis, it is their ability to frame questions and to express conjectures that is the journalist's most valuable skill—the data specialist can only find answers where it is known (or suspected) that questions lurk. One solution is to further improve training for journalists and journalism students—an approach which has obvious merit. Genis (2001) proposes several steps for remedial action, and handbooks exist for journalists struggling to come to grips with number-based stories (e.g., Wickham 2003; Livingston and Voakes 2005; Cohn and Cope 2012; Miller 2015). Improvements in journalism numeracy training will lead to an increase in technical proficiency and is to be encouraged.

However, a second approach suggests itself—and that is not only to modify journalism training, but to disrupt the culture of journalism itself. Rather than recruiting journalism students exclusively from the pool of those who have gravitated towards subjects such as English and history, an alternative is to encourage those to whom quantitative literacy comes naturally to apply to be journalists. In other words, journalism should be presented as an appropriate and attractive choice of university study to students who have excelled in maths or science at school. This is rarely the case at present—in the UK, there is considerable financial incentive for sixth-form students (i.e., those aged 16-18) who have studied science or mathematics to take STEM (science, technology, engineering and maths) degrees, not least because of the serious shortage of teachers in these subject areas. At the risk of making an over-generalisation, quantitatively-minded students at age 15 or 16 are guided to study maths or science, while their arts-inclined peers are shepherded towards creative writing or journalism. The lack of STEM students applying to study journalism has two consequences. First, the culture of journalism remains firmly based around the arts[7]; second, positions in data journalism tend to be filled by candidates who do not have journalistic backgrounds (since, as we have seen, journalists rarely have the skills or aptitude). There are notable exceptions, such as the European Journalism Centre's recent online data journalism course (EJC 2014), but these initiatives are not degree-level programmes aimed at prospective students. We should therefore not be surprised to learn that reporting that requires numeracy skills is neither as widespread nor as vigorous as it might be. The habitual coinage of a journalist's cultural capital is words, not numbers.

A natural objection is that students with strong numeracy skills may not be effective communicators. But there is no reason to think it is harder to teach communication skills to a science-based student than it is to teach numeracy skills to an arts-oriented student (and it is not always the case that arts students

[7] In the words of *Forbes*' writer Dan Seligman: "Liberal arts graduates control the media, which doubtless helps the prose – but generates endless screwups in numbers" (Seligman 2002).

have strong communication skills!). Indeed, some educators believe this approach would be a positive boon to STEM students: "Quality writing is … what STEM students need to learn" (Madison 2012, 3). The challenge is not only in the teaching but also in recruitment, since there is no tradition of STEM students being encouraged to study journalism—yet this could prove crucial to journalism's mission of "enhancing people's understanding of the world on issues likely to empower them as citizens in a democracy" (Cushion 2012, 2). An influx of STEM students would help shift the centre of cultural gravity from an environment which treats numbers with disdain to one which welcomes the precision they bring. Naturally, this approach does not preclude efforts to bolster numeracy among existing journalism students, which remains a necessary though complex challenge.

On a pragmatic level, it must be acknowledged that institutional inertia militates against any changes to admissions policies or procedures happening speedily or painlessly. Accordingly, an interim approach would be for journalism students to work alongside STEM students on joint projects or within workshop groups. Such activity undoubtedly occurs on an ad hoc basis in many institutions (at my own, journalism students have worked alongside coders from the ScraperWiki data aggregation project ScraperWiki.com to produce data-driven news stories), but there is no evidence this practice is common on a systematic or widespread basis. The pedagogical value of such interdisciplinary teaching and learning is summarised by Ellis (2009, 10) when he writes that, while the discipline-based approach has its conceptual advantages, it is also limiting: "There is always the possibility of substantial omission if knowledge is wholly structured within disciplines."

Conclusion

This paper has presented evidence regarding differences in performance between journalism and statistics students, and argues that journalism students perform weakly in an absolute sense and that these shortcoming become embedded in their professional practice when students take up jobs in the newsroom; examined some of the reasons for poor numeracy skills among journalists; and proposed that journalism would benefit from a change in culture as well as improvements in training. Although there may be structural obstacles (for example, Madison 2012 points to the difficulty of finding suitable instructors), there are pedagogical benefits from such an unorthodox approach. In bemoaning the gap between the culture of the arts and that of the sciences, C. P. Snow (1959, 9) spelled out what was in danger of being missed: "The clashing point of two subjects, two disciplines, two cultures—of two galaxies, so far as that goes—ought to produce creative chances."

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Appendix: Question paper and answers

Please attempt to answer all questions. You should circle the correct answer or write the correct answer in the space provided. Do NOT put your name on the paper – all answers are submitted anonymously.

Question 1: You want to make a small cake. You plan on using half of a cake mix. If the box tells you to use 1/3 of a cup of sugar, how much do you need to make your small cake? *[adapted from Ward et al]*

a) 2/6
b) 2/3
c) 1/4
d) 1/6

Question 2: If it takes you exactly 22 minutes to get to Uni, what time should you leave to arrive there at 9am? *[adapted from Ward et al]*

a) 8.32am
b) 8.38am
c) 8.42am
d) 8.44am

Question 3: If 80% of the population is exposed to swine flu, but only 20% of those exposed actually contract it, what is the percentage of the population that actually gets it? *[Ward et al]*

a) 42%
b) 60%
c) 16%
d) 20%

Question 4: Halley's comet passes by the Earth every 76 years. The last time it came was in 1985. When is the next time that it will pass by the Earth? *[Ward et al]*

a) 2051
b) 2076
c) 1985
d) 2061

Question 5: If person A's risk of getting a disease is 1% in 10 years, and person B's risk is double that of A's, what is B's risk? *[Lipkus et al; subsequently used by Ward et al]*

Answer: **2% in 10 years**

DOI: http://dx.doi.org/10.5038/1936-4660.9.2.3

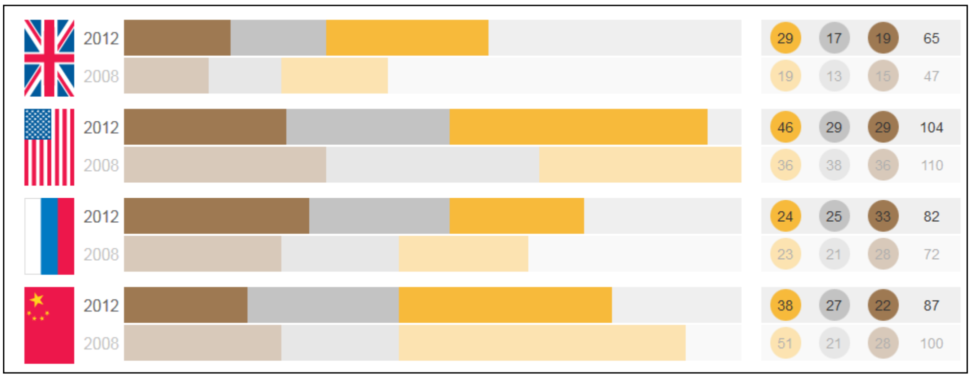
Question 6: You are at a restaurant and receive very good service. On a £40 bill, what is a 15% tip? *[adapted from Ward et al]*

a) **£6**
b) £2.88
c) £8.90
d) £4

Question 7: You have a fair coin, which means the chance of getting heads on a single toss is ½. Suppose you toss the coin 10 times and get 10 tails in a row. Is the chance of getting a head on your next toss more than, less than or equal to ½? Explain your reasons briefly. *[adapted from Ward et al]*

Answer: **It is still ½. Each toss is independent.**

The chart below shows how many bronze, silver and gold medals were won by Britain, USA, Russia and China in the 2012 Olympics compared with the 2008 Olympics. The final three questions are based on this chart.



Question 8: Which team of those shown won the most gold medals in 2012?

Answer: **USA won the most gold medals in 2012 (46 of them).**

Question 9: Which team of those shown won the fewest bronze medals in 2008?

Answer: **Britain won the fewest bronze medals in 2008 (15 of them).**

Question 10: Approximate the percentage increase in Britain's total number of medals from 2008 to 2012.

Answer: **Range 33%-40% is acceptable (to one decimal place, the answer is 38.3%).**