Playing with numbers: Using Top Trumps as an ice-breaker and introduction to quantitative methods

Abstract

Statistics anxiety has been widely documented among both postgraduate and undergraduate social science students and shown to be an obstacle in engaging students in quantitative methods. This article builds on previous studies that have highlighted the utility of fun and play in productive learning and overcoming anxiety. A personalised version of the game Top Trumps was developed for use with a class of postgraduate sociology students in the UK. This game provides an ideal way for students to inductively learn about basic statistical concepts, such as range and dispersion. The game also creates opportunities to engage students in critical discussion of measurement and social categorisation. The article suggests that the employment of play and hands-on exercises, especially when used in the first week of a quantitative methods module, can stimulate student interest, ameliorate statistics anxiety and encourage critical discussion, thereby positively impacting learning goals in the rest of the module. The article ends by explaining how to adapt the exercise for use within an undergraduate module.

Introduction

In this article I describe an adapted game of Top Trumps that I developed in teaching a postgraduate level quantitative methods course in a UK sociology department, and which I have since employed in undergraduate teaching. I first address the issue of student statistics anxiety, since it is against this backdrop that any statistics teaching must take place in sociology (and in most social sciences). I suggest that this anxiety is rife among both postgraduate and undergraduate students, albeit rooted in slightly different experiences. I propose that in this context the employment of play and hands-on exercises in the first week of a quantitative methods module serves to stimulate student interest, ameliorate statistics anxiety and encourage critical discussion, something that has residual positive effects for the rest of the module. In the remainder of this article I describe Top Trumps (for those not familiar with it), explain how to personalize this game for use in a statistics classroom, and focus on different ways in which Top Trumps can introduce a sociological approach to quantitative methods. In the final section I review student feedback and draw conclusions about the strengths of this approach.

Undergraduate and Postgraduate Statistics Anxiety

Much has been written about undergraduate students' "statistics anxiety" (Blalock 1987; Fisher-Giorlando 1992; Leming 1979; Paxton 2006; Potter 1995; Schacht and Stewart 1990). This anxiety is such that "sociology undergraduates tend to want to avoid mathematics in general and some feel incapable of performing even basic mathematical operations" (Paxton 2006, 65). Writing about postgraduate statistics teaching, Timothy Patrick Moran dismisses approaches that focus on fear as concerning themselves with "undergraduate issues"; the implication is that these are not of relevance to postgraduate students.

> "Most teaching statistics literature concerns itself with undergraduate-level issues. Approaching the problem from a student-centred angle, most of this writing consists of strategies and techniques aimed at helping the quantitatively petrified learn statistics, the general idea being to ease student anxiety and/or engage in more fun, interactive learning." (Moran 2005, 263 ff 1)

In contrast, Moran suggests that graduate courses should "demystify" statistics by developing a critical historical perspective to its study that focuses on the controversies surrounding the introduction of particular statistical techniques, such as the null hypothesis inference test (Moran 2005:266-9). His suggestions are useful, and I support giving space to discussion of the political and historical role of statistics in society (in this context I have found that Dorling and Simpson's (1999) critical and readable collection is a useful starting point). Onwuegbuzie and Wilson (2003), however, provide voluminous evidence that statistics anxiety affects both undergraduates *and* postgraduate students. They estimate that statistics anxiety effects between two-thirds and four-fifths of postgraduate students (2003:195), leading to negative outcomes, including poorer academic performance (2003:199-201). Ignoring these well-substantiated findings cannot be beneficial to the teaching of postgraduate quantitative methods.

My experience of teaching quantitative methods to postgraduate sociology students in the UK and undergraduate students in the UK and US supports the findings of Onwuegbuzie and Wilson. Despite postgraduate students' academic confidence, as witnessed in their decision to pursue a program of advanced education, their statistics anxiety can be as severe as their undergraduate counterparts. This was brought home to me in the 'taster' session to the first postgraduate class I taught (designed to give students an opportunity to find out what was in store for them and ask questions). The session was attended by 11 students, who filled in a mini-survey I had produced for illustrative purposes. In this survey four of those present

categorized themselves as “terrified” about the upcoming module, with a further three “nervous, but not quite terrified”. Just one student claimed to be “enthusiastic”. Moreover eight out of 11 students enrolled on the module because it was a requirement.

Students’ terror/anxiety about statistics or quantitative methods is closely correlated to anxiety about maths (Onwuegbuzie and Wilson 2003:196-97). This is exacerbated by the anti-math selection bias among social science students; with the choice to pursue a social-science education in some cases itself indicative of a disinclination for, or lack of achievement in, science subjects.

By the time they embark on postgraduate study, British sociology students are unlikely to have studied maths or statistics in the recent past: the majority of students in the taster session stated that it had been over five years since they had done either. This is hopefully changing, with ESRC/Nuffield/HEFCE funded schemes, including Q-Step[1], increasing the breadth and depth of undergraduate social science quantitative training, but these schemes will take some time to impact postgraduate cohorts substantially. Moreover, since sociology postgraduate training in neither Britain nor the US requires students to possess a sociology first degree changes to the undergraduate curriculum are unlikely to fully resolve the issue. One final point of national difference is that the standardised aptitude tests required for US university entry (the SAT and GRE), include basic mathematics. This means that US students are more likely than British to have revised basic mathematics shortly before beginning a university sociology course. While this may provide some advantages it is likely to remain the case that a large proportion of undergraduates and postgraduates in both countries begin their degrees with only a fleeting familiarity with social statistics.

Where incoming postgraduate students differ from undergraduate is that their intellect is perhaps more centrally constitutive of their sense of self. Encounters with a subject in which

they feel incompetent will therefore be additionally undermining, and the fear of being seen either by instructors or other students as foolish, perhaps more acute than the equivalent fear among undergraduates. In addition, the institutional quantitative-qualitative division in sociology (Tilly 2004) provides discursively able postgraduate students with the tool-kit to re-frame fear of statistics, legitimizing fear as an 'epistemological choice' to use qualitative methods. This reinforces pre-existing psychological barriers to the comprehension of quantitative methods (a comprehension that paradoxically is the pre-requisite for making such an epistemological choice). This means that any instructor wishing to deal with 'statistics anxiety' among sociology postgraduate students must counter both student worries about their own incompetence and their legitimation of this incompetence as philosophical stance (Williams, Collett, & Rice, 2004). Games and hands-on exercises can introduce levity and encourage playful interactions amongst class-members and in doing so they establish an environment in which students feel less anxious, are able to ask for help and also feel free to question the epistemological basis of what is being taught.

The approach described here builds on analyses that have highlighted the need to develop statistical reasoning and dynamic student teacher interactions (Bradstreet, 1996) as well as on studies that have shown that fun is productive for learning (Lesser & Pearl, 2008). The game of Top Trumps described below is designed for the first day of class. As such it is in line with Macheski et. al.'s (2008, p. 44) suggestion that in teaching difficult subjects, like statistics,

> ...a key step in constructing a community of learners begins on the very first day. Faculty need to begin constituting their class as a *community of people*, that is, the first day experience needs to focus more on building relationships rather than course content. Classroom activities need to be interactive, creating an environment that feels

> emotionally safe to students, and which allows them to get to know each other in a relaxed atmosphere that is nonthreatening, and even fun.

In distinction, however, to these authors' juxtaposition of fun and relevance, the game described here is interactive *and also* provides a way to develop students' statistical thinking from Day One.

Top Trumps

1. How to play

Top Trumps is a children's card game, initially popular in the UK in the 1970s and 1980s. It was revived in the UK in 1999 and introduced into the US and elsewhere.[2] Each pack of Top Trumps has a different theme (i.e. racing cars, footballers, Buffy the Vampire Slayer, The Simpsons). Each card pictures an item (super-hero/footballer/type of race car etc). This item is then scored using a set of measures specific to the pack's theme. For example the Buffy cards include the categories: Combat Daytime (rated 1 to 10); Combat Night-Time (1-10); Fright Factor (1-10); Killer Rating (%); and Intelligence (%). In contrast, footballer top trumps include: Height (cm); Career goals (N); International caps (N); Trophies (N); Year of birth (Year).

To play Top Trumps the pack is dealt out to two or more players. These players then play their cards in the order dealt. The aim is to win rounds and take cards. To play a round the player to the left of dealer calls out an attribute on which they think that the card being played is strong (for example if I held the card for Spike, a vampire character, I might choose the category Combat Night-Time where he rates nine out of ten; whereas it would not make sense to use the category Combat Daytime since as a vampire he rates just three). Each player will then state the score of the card at the top of their deck in the designated category. The player whose score in that category is the highest wins the round. The winner takes all of the

cards played in that round, places them at the bottom of his or her pack and then looks at the next card in his or her pile to select the category for the next round of cards. And so it goes on. When a player has no cards left he or she is out. The eventual game winner is the player left with all of the cards.

As players become familiar with what is 'high' and 'low' for a particular category they become better able to predict whether the scores on one of their cards in a particular category is high or low. Winning the game relies on this skill: the ability to predict which category is likely to be strongest in comparison to others' scores. For instance, it is only by knowing how others score that I can determine whether an intelligence rating of 60% is likely to be high enough to win a round. Thus to successfully play Top Trumps players must begin to inductively assess the range of a set of scores. This is a valuable introduction to thinking through introductory statistics and relates to the teaching activities described below.

2. Producing personalized Top Trumps

Before the first seminar of the module I produced a set of personalised Top Trumps cards in which I placed photos of each of the students on the module onto a playing card containing the student's name. Photos of students are made available to instructors in my department via a departmental database and can be printed out. Where photos are not available instructors may choose to leave the picture space blank, enabling students to 'draw' themselves, or might want to insert cartoon images. An example card is shown below with a picture of Karl Marx (who was not in my class). The version that I used had a brightly coloured (rather than grey) border.

[Figure 1 about here]

As can be seen the categories that I chose were light-hearted: *Genius Rating*; *Laziness*; *Number of Pets Ever*; *Number of Jobs Ever*; *Height* and *Strength*. Some of these categories (*Genius Rating* and *Strength*) were modelled on the types of categories found on super-hero Top Trumps cards which focus on characters' "powers". *Height* is a category often found in sporting hero Top Trumps. Others had more sociological roots (*Number of Jobs Ever*). And both *Laziness* and *Genius Rating* turned a non-serious spotlight on students' academic prowess. What was most important however was that categories should: a) for the most part have numeric responses, ideally with a range of between zero and 20 (or that could be scored as a mark out of ten); b) be easily scored by everyone in the class; c) be willingly scored (thus the light-hearted *Genius Rating* rather than 'Intelligence', a category more usually used in Top Trumps but a quality which may demand more serious self-analysis to score, and consequently more self-exposure); d) vary across students; and e) potentially contain interesting or fun information. Also important, as I shall discuss, was the ambiguity of some of the categories.

In the first seminar meeting, attended by about 25 students, I passed round the cards and told students to take their card. I had produced some blank cards (with no name or photo) in case students who had not enrolled or been on my register turned up. Students who did not find their card in the pack were instructed to take one of these blanks, write in their name and draw themselves in the space provided – some rather comical stick-figures and lopsided faces resulted. Each student was then instructed to fill in their own scores. This almost immediately turned into a discussion of the meaning of several of the categories. *Strength* was especially problematic. "What kind of strength to do you mean?" someone asked, "Emotional or physical strength – I don't understand?" I responded that they should answer as they saw fit. More importantly this generated a short discussion that harkened back to the first lecture of the module (given that morning) in which the problems of quantifying social phenomena had

been introduced. We talked about which of the categories were more or less problematic to quantify. *Height* was straightforward (although some confusion emerged with European students using centimetres and UK students, feet and inches). *Number of Jobs Ever* was easy for those who had had few, but difficult for students who had had over ten. Moreover it was seen as debatable that someone who had held three jobs over a single summer had held three times more jobs than someone who had held the same job for several years, and how to count babysitting generated quite heated discussion. Similar problems emerged for the pets count since the person who'd had the most pets had had a series of goldfish, which other students were unconvinced 'counted' as real pets. Thus in responding to some very simple categories we were able to enter into a discussion about the meaningfulness of quantification. This addressed students' lack of conviction that numbers were important by allowing them to see that in this de-contextualized game it was difficult to decide how to count, and that context was necessary for determining what 'counted' and what did not. It also highlighted the differently problematic nature of different types of counts (for example that *Height* was relatively unproblematic).

3. Playing the game in class

After students had filled out their cards they were put into three groups. Each group collected together the cards of those in their group and placed these in a pile (face down). The different groups then played each other at Top Trumps. This part of the activity had three purposes. Firstly the game simply served as an ice-breaker. Secondly, because students were in effect playing using themselves as characters (and as cards changed hands sometimes losing out to the card representing themselves) it became quite common for them to challenge the scores when these were especially high or low, sometimes re-opening discussions about the meaning of different counts. This led to good humoured banter and allowed students to express themselves freely in my presence, an important precedent to set in the first meeting. The

banter also gave students a chance to get rid of some of their maths-anxiety tension, allowing less maths-able students to speak with confidence. Thirdly, as suggested above, the game allowed students to start getting a feel for the spread of scores and to see that they can discover the range – high, low and middling scores – for themselves. I initiated a brief discussion of this last aspect of the game, asking students to contribute ideas about average scores for different categories and discuss how they arrived at the responses that they gave. This led nicely into the next set of Top Trump activities.

4. Using Top Trumps to introduce statistics

After one team had emerged victorious from the game I collected up the pile of cards, divided the class up into groups of five and redistributed the cards (giving five to each group). I then delivered a series of short review lectures on averages (mean, median, and mode); dispersion and variability (quartiles and standard deviation); and finally, the normal distribution and z-scores. After covering each topic I stopped and the groups were told to use their cards to calculate the relevant measures (for example work out the mean, median and modal values for their five characters' *Laziness Ratings*). This is where it became important that the scores for each category involved relatively low numbers, enabling simple mathematical calculation. Using cards (rather than a list of numbers) for calculations was especially useful when it came to thinking through measures of central tendency: the median could be found by rearranging cards into the 'right' order and picking out the middle card and the mode by putting the cards into piles matched by score and selecting the biggest pile. The fact that there were potentially six different categories in which averages could be calculated meant that groups that finished the calculations for one category had plenty of material to keep them occupied while I helped other groups. Since groups have different sets of five cards, all with the same categories, it would be possible to also discuss sampling distribution using the cards; however given the time constraints I did not do this. Because we were using cards

representing their classmates and scores that they had contributed themselves students found the results both relevant and interesting, and we could talk about the substantive meaning of these easily and jokily, discussing students' average laziness and standard deviations of genius. As has been noted (Schacht and Stewart 1990; Schacht and Stewart 1992), humour is an excellent tool in teaching statistics and reducing anxiety.

The seminar lasted a total of two hours. By the end I had got to know the students fairly well and they had become familiar with me and with one another. We had also covered a considerable amount of material for an introductory session and I had some idea of different students' abilities. In addition students asked questions of me and of each other, and they left the class-room smiling and joking.

Evaluation

During the ten week course I ran two other hands-on seminars. In one I used personal ads to introduce sampling, coding, and the construction of contingency tables (Rushing and Winfield 1999). In the other, students produced posters to visually represent published multivariate analyses (in other weeks the time was spent in computer labs where students learnt how to use SPSS). In evaluation forms completed at the end of the course students were asked to comment about the three 'practical seminars'. In particular a question asked whether the three seminars were useful/helpful. Student responses included: "Yes and they were fun"; "useful and enhanced understanding of stats"; "[I] enjoyed the practical seminars and learned more in them than first anticipated!"; "Very useful"; "Useful and good fun"; "Well organized and very interactive"; "These were the most useful ways of operationalizing the concepts we were learning". Other responses echoed these. Furthermore, no negative reactions were received (interestingly both more and less statistically-able students were enthusiastic about the Top Trumps session). Thus students found play and hands-on sessions enjoyable *and* believed that these had improved their understanding of quantitative methods.

Most importantly, these sessions contributed to a more general positive response to the module. Despite their trepidation on entering the course, nearly half of students described the course, or quantitative methods, as "fun" or "enjoyable" in their evaluations. Many used words like "interesting" and "stimulating". Several mentioned their loss of statistics anxiety (i.e. "I don't feel scared of quants, and feel positive about them and hopefully will use some simple stuff in [the] future"; "the module has helped to remove some of my stats/computer gremlins, feel much more positive about it"; "started off disliking it – but found it interesting… later!"; "I am more open to [quantitative methods]"; "I still find quantitative methods complex, but more manageable"). More confident students described instances when they had already, or were planning to, use quantitative methods in their research. These evaluations provide considerable evidence that the module did succeed in its central aims: diminishing student statistics anxiety and enabling postgraduate students to reach the point where they can make informed decisions about whether to use, or not use, quantitative methods in their own work. Students' positive assessment in their evaluation forms was also reflected in an absence of crises relating to this course (these crises have occurred in previous years when students who must take the course to receive their MA feel that they have come up against a brick wall). Thus the impact of the introduction of the type of instruction described here goes well beyond the particular sessions in which it is used, permeating the whole module, and potentially enabling the retention of students' self-confidence in the face of the inevitable moments when they feel confused. As one student commented, "[I am] still confused but much more comfortable with finding answers." It seems to me that this level of comfort is perhaps the most lasting outcome that a single course in quantitative methods can deliver.

Conclusion

Top Trumps is a simple and enjoyable game to play, requiring no prior knowledge to understand the rules. It is also easily customizable (it would certainly be possible to create a pack of 'Sociological Theorists'; 'Media Conglomerates'; or any number of sociologically related themes if instructors preferred these). Moreover, it is an ideal way of introducing discussion of quantification and basic ideas of central tendency and distribution, the essential building blocks of statistical reasoning, but topics which are not always sufficiently understood (Garfield & Ben-Zvi, 2007, p. 386). Taking up two hours of a course with a 'game' may appear frivolous but it proved beneficial, especially in tackling statistics anxiety, and encouraging student voice, as well as legitimating a critical approach. Play activities transformed a "dull" and "scary" course into one that students found "interesting", "useful" and "fun", and produced a course that I enjoyed teaching. Given research showing that positive instructor interactions do a lot to decrease statistics anxiety (Onwuegbuzie and Wilson 2003:203-4), this will have created additional benefits.

Since the 1999 re-launch of Top Trumps the game's educational benefits have been highlighted in a series of exercises for school teachers collated by TES Connect[3]. These exercises are interesting but differ to that suggested here in two ways. First they tend to use Top Trumps like flash-cards, to facilitate students' retention of the information presented on the cards and do not emphasise the potential of the game to develop an inductive understanding of range and distribution. Second, the school-focused exercises adopt a more positivist relationship to the scores on the cards, whereas this exercise is designed to prompt questions about social categorisation and quantification.

The above discussion relates to employing Top Trumps in a postgraduate seminar. I have, however, also worked alongside two postgraduate teaching assistants to successfully incorporate Top Trumps into a required first year undergraduate sociology class. The main

difference was that the undergraduate students were less vocal than the postgraduates in critiquing the meaning of categories and slower to relate discussion over the validity of measurement to broader questions of sociological methodology. They, were, however quite able to make these connections, once prompted to think about them by their instructors.

[1] See: www.nuffieldfoundation.org/q-step
[2] See: www.toptrumps.com
[3] See: www.tes.co.uk/article.aspx?storyCode=6153662

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Figure 1. Example of a personalized "Top Trump" Card