"AND THE SURVEY SAYS…": USING *FAMILY FEUD* TO GATHER, UNDERSTAND, AND ANALYZE DIFFERENT LEVELS OF DATA

John S. Seiter, Utah State University, Timothy Curran, Utah State University, and Kristina Scharp, University of Washington

TOOL BOX: "AND THE SURVEY SAYS…": USING *FAMILY FEUD* TO GATHER, UNDERSTAND, AND ANALYZE DIFFERENT LEVELS OF DATA

Some time ago, while providing an example of nominal level data, one of the authors categorized Democrats, Republicans, and Independents using the numbers one, two, and three, respectively. Not recognizing that the numbers functioned as labels rather than values, a student wondered why Republicans deserved the higher "score." "What if Democrats are better?" she asked, and it was hard to blame her. Indeed, as previous literature notes, learning statistics can be daunting, particularly in disciplines within the Social Sciences, where students might be math-anxious (Brown, 2017) or might perceive the subject as dry or unpleasant (see Carnell, 2008; Fawcett & Newman, 2016). One approach for overcoming such challenges is through the use of classroom activities (Dillbeck, 1983; McPherson, 2014). By way of example, recent articles have demonstrated the ways in which teachers can use cartoons (Lesser, 2017) and dice games (McPherson, 2014) to engage their students in statistics content. Others have suggested that adaptations of game shows such as *Wheel of Fortune, Deal or No Deal,* and *The Price is Right* provide appealing sources of statistical fun (Lesser, 2007; Quinn, 2003). It is in that spirit that we present an activity we have used in our own classes. Specifically, the activity provides a unique, interactive approach by adapting the popular television show *Family Feud*—which is based on survey data—to a lesson on levels of measurement, a crucial topic in such courses. To be sure, understanding different levels of measurement is important to student learning because measurement levels determine the relationship between attributes for a variable. For example, attributes in nominal level measurements are distinct from one another, whereas the distance between attributes in interval level measurements can represent the overall presence or absence of a variable (Babbie, 2017). Moreover, levels of measurement determine the statistical analyses available to researchers to test hypotheses. Thus, understanding levels of measurement can help students understand choices in the research process that produce different levels of information.

Although this "toolbox" entry focuses on helping students recognize different levels of data, it can also serve as a springboard for presenting other concepts, including measures of central tendency, and graphing, analyzing and reporting research results. Thus, although the activity can be conducted in a single class session, it can also be expanded to additional sessions that cover more sophisticated statistical analyses.

EXPLANATION OF THE ACTIVITY

OVERVIEW

Previous literature has highlighted the value of creating datasets that stimulate student's interest while introducing statistical concepts (e.g., see Brown, 2017). Along these lines, in this exercise, students "collect" different types of data (i.e., nominal, ordinal, interval, and ratio) by playing a classroom version of *Family Feud*. Although students who are familiar with the show might know that it features two teams competing to name the most popular responses to survey questions, they might be surprised and interested to learn that data contained in those surveys represent different levels of data.

MATERIALS AND PREPARATION

To conduct the activity, you will need several surveys, one for each preliminary round and five for the "fast money" round (see Appendix A for surveys that we created with our students or search online for existing *Family Feud* surveys). As you can see in Appendix A, each prompt includes answers that range from most popular to least popular. Beside each answer is the number of respondents out of 100 who gave that answer. Also notice that the answers to different surveys represent nominal, ordinal, interval, or ratio levels of data. The prompts in Appendix A are relatively light topics to keep students comfortable throughout the activity. To create answer boards, search online for an array of free *Family Feud* Power Point templates.[1] In the event that such resources become obsolete or unavailable, you can create your own using posters, overheads, or dry erase boards. Also, considering an array of previously published exercises that speak to the value of increasing students' engagement through the use of prizes, music, and relevant artifacts (e.g., see Seiter, Peeples, & Sanders, 2018), you might plan to bring prizes, a bell or buzzer, and consider downloading the *Family Feud* theme song, which can be played as students arrive to class and at appropriate times during the activity. In our experience, students seem more enthusiastic about the exercise when such elements are included. That said, the point of the exercise is not to replicate the television show in the classroom, but rather to provide an engaging introduction and pathway to learning the material. With that in mind, prior to the session, make sure your students are familiar with different levels of data, measures of central tendency, frequency distributions, and how to graph data. In addition, remind them periodically how the activity relates to course material.

PROCEDURES

On the day of the activity, divide your class into two "families," explain the rules (see Appendix B), and begin. Play three preliminary rounds until a winning team is declared, and then invite two members of the winning team to play "fast money." Encourage teammates to root the fast-money players on in order to keep everyone engaged. Afterwards, ask your students if they can figure out what this game has to do with the class. Guide them toward talking about levels of data (i.e., nominal, ordinal, interval, ratio). Ask them whether any of the levels are represented in the game and, if so, which ones. Help them understand how and why the answers to the surveys represented different levels of data. For example, have them

[1] We particularly like the template from youthdownloads.com (then click on "games"). For additional options, see Fisher (2019).

explain why reports of temperature are interval level data rather than ratio. Congratulate them on having "collected" data.[2]

Next, ask your students how the data from the surveys might be analyzed. For example, you might ask them if there is a frequency distribution and/or about which measures of central tendency apply to a particular survey. Is there a mean, median, and/or mode? Why or why not (e.g., there is no mean for nominal level data)? Can the data be represented visually? To increase individual students' engagement and discourage passivity, rather than work with the entire class, break your students into groups (or subgroups, depending on the size of class). Ask each group to depict one of the surveys using a graph or chart (e.g., pie chart, bar graph, and box and whisker chart) and then invite students to present their depiction to the rest of the class while describing what the graph means.

Next, as an optional activity, consider asking students (now or, most likely, later in the semester) to analyze the data statistically. For example, consider the prompt "Name a nut other than a peanut," and its accompanying answers: Almond (37); Walnut (23); Cashew (17); Pistachio (10); Pecan (5); Macadamia (4); Hazelnut (2); Chestnut (2). If the categories are equally likely, students can run a one-way chi-square statistical test to determine if the data was normally distributed. Have the students calculate the chi-square statistic, determine the degrees of freedom, determine an alpha level, and compare their chi-squared results to the critical value. Appendix C has the information to help students complete chi-squares on the nominal level data.

As another example, consider the prompt "How many glasses of water does the average person drink in one day?" By asking students to imagine that only people from the US had answered the survey, and then providing hypothetical survey results that people from either Canada or Mexico answered (see Appendix C), they can run a *t*-test to determine if two groups are statistically different. Similarly, by asking students to imagine that only people from the United States had answered the survey, and then providing hypothetical survey results from Canada and Mexico, they can run a one-way analysis of variance (ANOVA) to determine if all three groups are statistically different.

Finally, have students write a sentence that summarizes their findings (e.g., rejecting or failing to reject the null hypothesis). Overall, the analysis portion of this activity can help students understand null hypotheses, alpha levels, and accurately write research findings.

DEBRIEFING

After playing, discuss how phrasing questions yields different levels of measurement. You might also ask students to take some of the nominal level examples and rephrase the prompts to yield interval or ratio data and vice versa. We also recommend discussing the benefits of being able to detect central tendencies. A question that might help guide your discussion is "what type of information do we miss out on when we have nominal level data?" This is a good time to show students the limits of nominal level data (e.g., the lack of central tendencies and the limited analyses to run). If your course, like ours, involves a research component, the debrief period also functions as an ideal time to discuss typical errors that students might commit when writing up their research findings (e.g., "We *proved* that our hypothesis was

[2] Here, you might help students understand that you are using the term "collected" in a playful way. While *Family Feud* provides an entertaining vehicle for considering multiple types of data side-by-side, *real* data collection involves a variety of approaches that you might consider discussing, including surveys like those featured in the game.

true."). Similarly, this activity also allows for discussions about topics (e.g., sampling and generalizing results) that students might encounter when reading and evaluating others' research or when conducting their own research. For example, the one-way ANOVA can help students understand how sample demographics can skew answers. This is also an opportunity to discuss how determining an alpha level can dictate conclusions that your students or others draw regarding statistical significance. If you prefer to have students compute statistics, there are several sources you might consult (e.g., Bruning & Kintz, 1987; Meyers, Gamst, & Guarino, 2013).

CONCLUSION

Although teaching statistics courses presents particular challenges, such courses invite teachers to seek innovative ways to engage students (Acton & McCreight, 2013; Leston-Bandeira, 2015). To that end, and in our experience, students enjoy participating in this activity. Based on anonymous feedback we have collected, students comment that this activity helped build classroom rapport and made it easier for them to participate in the discussion afterwards. Typical feedback also suggests that students especially like it when the teacher embraces the role of emcee (e.g., by encouraging them to root for their teammates or by interviewing them briefly when it's their turn to respond [e.g., "What do you do for a living?" "Any hobbies?"]). Fostering this type of environment is particularly important in statistics and quantitative research methods courses where students might be more concerned about their mastery of the material. Besides building rapport, this exercise has proven effective for helping students understand different levels of data, graphing, and analysis.

As an alternative, this activity also works well if you play *Family Feud* before students are exposed to key concepts, and then use examples from the game to illustrate various levels of data. You can also abbreviate the game to suit your needs. For instance, to cover only nominal data, you could skip playing the fast money round. Moreover, to keep both teams engaged, you can consider picking one member from each team to play the fast money round. Finally, for more advanced students, you can include a discussion about how the classification of measurement is not always clear-cut and can vary based on the context of the question (see Velleman & Wilkinson, 1993).

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APPENDIX A: SURVEY PROMPTS AND ANSWERS

PRELIMINARY ROUNDS

Prompt for round 1 (Nominal data): "Name a nut other than a peanut." Almond (31); Walnut (22); Cashew (14); Pistachio (9); Pecan (5); Macadamia (4); Hazelnut (4); Chestnut (2).

Prompt for round 2 (Nominal data): "Name an animal you would find on a farm." Cow (44); Pig (28); Chicken (12); Horse (9); Dog (4); Sheep (3).

FAST MONEY

Prompt for question 1 (Nominal data): "Name an orange vegetable." Carrot (50); Sweet potato (20); Squash (18); Orange pepper (12).

Prompt for question 2 (Ordinal data): "How would most people respond to the following question: On a scale of 1-10, how funny are you?" 5 (7); 6 (16); 4 (10); 8 (25); 7 (25); 9 (7).

Prompt for question 3 (Interval data): "Rounding up to the nearest ten, what is the ideal temperature for a beach day" 80 degrees (65); 90 degrees (20); 100 degrees (10); 70 degrees (5).

Prompt for question 4 (Ratio data): "How many glasses of water does the average person drink in one day?" 3 glasses (25); 5 glasses (23); 4 glasses (20); 8 glasses (15); 2 glasses (5); 6 glasses (10); 10 glasses (2).

APPENDIX B: RULES FOR PLAYING *FAMILY FEUD*

1. Purpose: The purpose of the game is to accumulate points by guessing the most popular answers to a survey that included 100 people.

2. The Face Off: Each round begins with a face-off between one member from each team. These two contestants are invited to the front of the classroom and asked to guess the results of a survey, whose answers are concealed on a board and ranked in popularity. Whichever contestant buzzes in first tries to guess the most popular answer, and, if correct, wins the face off. Otherwise, the opponent tries. Whichever contestant had the "best" answer (i.e., ranked higher than the opponent's answer), wins the face off. If neither answer is on the board, the contestants' teammates take turns trying to guess. Whoever wins the face off can choose whether to play or pass (in which case the opposing team plays).

3. One at a time and without help from teammates, members of the "playing" team take turns trying to guess the remaining concealed answers. Each person gets about 3 seconds to answer. If correct, the concealed answer is revealed and the next teammate guesses. If the team identifies all the concealed answers, it wins the round. If, on the other hand, a team member guesses incorrectly, the team receives a strike. If the team receives three strikes, they are "out."

4. Stealing the Round. Meanwhile, the opposing team secretly discusses possible answers. If the "playing" team strikes out, the opposing team tries to steal the round by identifying just one of the remaining concealed answers. If successful, that team wins the round. If not, the original, "playing" team wins the round.

5. Scoring. Answers are worth one point for however many people in the original survey provided that answer (e.g., if 21 people surveyed gave an answer, the answer is worth 21 points). Whichever team wins Round One earns ALL of the points for all of the revealed answers, regardless of which team guessed the answer. Same for Round Two. Round Three is worth double points. Whichever teams has the most points after Round three is declared the winning team.

6. For the "fast money" round, one member of the winning team answers five survey questions in 20 seconds, while a second team member waits outside. Afterward, the second team member is given 25 seconds to answer the same five questions, trying again if a duplicate answer is given. If their combined score equals 200 or more points, they win.

APPENDIX C: HELPING STUDENTS COMPLETE STATISTICAL ANALYSES

1. NOMINAL-LEVEL DATA OPTIONS

Below is the information to compute chi-squared analyses for nominal level data. Start the analyses by telling students that they are testing whether people were more likely to choose some answers over others (i.e., not all answers had an equal likelihood of being chosen). Thus, the null hypothesis is that each answer had an equal chance of being chosen by participants. We recommend making a chart with the following categories: Answer, Observed, Expected, (Observed – Expected), $(\text{Observed} - \text{Expected})^2$, $(\text{Observed} - \text{Expected})^2/\text{Expected}$.

2. THE T TEST AND ANOVA

Below is the material you need to compute the t-test comparing answers based on countries. Because the t-test is used to compare the means between two samples, and because the survey results from the fast-money round included only one group, we have included data from two, hypothetical groups that can be used in the analysis. Thus, you can tell your students to pretend that the fast-money results were answers from people in the United States only and the hypothetical data represent answers from Canadians or Mexicans.

You can also use the data below to compute the ANOVA comparing people from all three countries. Because the ANOVA is used to compare the means from more than two samples, and because the survey results from the fast-money round included only one group, we have included data from two hypothetical groups that can be used in the analysis. Thus, you can tell your students to pretend that the fast-money results included answers from people in the United States, and that the hypothetical data represent data from Mexicans and Canadians. Specifically:

1. Fast money answers by people from the U.S. to the prompt "How many glasses of water does the average person drink in one day?": 3 glasses (25); 5 glasses (23); 4 glasses (20); 8 glasses (15); 2 glasses (5); 6 glasses (10); 10 glasses (2).

2. Hypothetical answers by Canadians to the same prompt: 3 glasses (10); 5 glasses (30); 4 glasses (10); 8 glasses (30); 6 glasses (20).

3. Hypothetical answers by Mexicans to the same prompt: 5 glasses (5); 4 glasses (10); 8 glasses (50); 2 glasses (5); 6 glasses (30).

Below is a chart of the solution for the ANOVA comparing the three groups

ANOVA						
	Sum of Squares	df	Mean Square	F	Sig.	
Water_CND	Between Groups	178.910	6	29.818	28.562	.000
	Within Groups	97.090	93	1.044		
	Total	276.000	99			
Water_MX	Between Groups	262.117	6	43.686	124.499	.000
	Within Groups	32.633	93	.351		
	Total	294.750	99			