Comfort Page for Bivariate Statistical Analyses

1. Determine the appropriate statistical model, based on …
    a. the variables involved (qual vs. quant)
    b. type or research hypothesis (mean dif, pattern dif or linear relationship)

2. "Draw the boxes" for the RH:
    a. 2-cell box for ANOVA – label IV and its conditions and specify if BG or WG
    b. scatterplot for r – label variables
    c. 2x2 for X^2 -- label both variables and the conditions of each

3. Specify H0:
    a. "no mean differences" for ANOVA – symbolic representation using = for 2-cell box
    b. "no linear relationship" for r – draw circle in scatterplot
    c. "no pattern of relationship" for X^2 -- symbolic representation using <. > & = in 2x2 box

4. Specify RH:
    a. "mean difference" (or not) for ANOVA – symbolic representation using <, > or = for 2-cell box
    b. "direction of linear relationship" (or not) for r – draw ovoid or circle
    c. "pattern of relationship" (or not) – symbolic representation using <, > and/or = in 2x2 box

5. *A priori* power analysis -- need effect size estimate and desired power to look up sample size
    a. S = N for study using ANOVA, N/2 = n in each condition
    b. S = N for study using r
    c. S = N for study using X^2 (divide into haves if one of the qual variables is an "IV")

6. Data Cleaning & Transformations as necessary
    a. Remember to do separate outlier analyses for each condition of ANOVA designs

7. H0: test
    a. For ANOVA -- use $p < .05$ or $F > F\text{-critical}$ ($df = 1$ & $N-2$)
    b. For r – use $p < .05$ or $|r| > r\text{-critical}$ ($df = N-2$)
    c. Fro X^2 -- use $p < .05$ or $X^2 > X^2\text{-critical}$ ($df = \#row-1 * \#col-1$)

8. Determine probability of NHST error
    a. If reject H0: -- probability of Type I error is p (or .05 if used critical value to make the decision)
    b. If reject H0: -- probability of Type III error is not easily calculated
    c. If retain H0: -- probability of Type II error is 1 – power
        - Power estimate requires r & S
        - Calculating r for ANOVA or X^2
            - For ANOVA -- $r = v(F / (F+dferror))$ dferror = N-2
            - For X^2 -- $r = v(X^2/N)$
        - Calculating S
            - For ANOVA – S = dferror + 2 = N
            - For X^2 -- S = N (might have to count up the numbers in the four cells)
            - For r – S = df + 2 = N

9. RH: test -- be sure to check direction of effect and of RH (not just celebrate if reject H0:)
    a. For ANOVA – does pattern of mean difference match RH: (RH: might be H0:) – no partial support
    b. For r – does direction of linear relationship match RH: (RH: might be H0:) – no partial support
    c. For X^2 -- does pattern match RH: (RH: might be H0:)
        - about "partial support" – we'll limit it to when there is an effect ($p<.05$) but not the specific RH: pattern

10. Calculating Effect Size
    - For ANOVA -- $r = v(F / (F+dferror))$ dferror = N-2
    - For X^2 -- $r = v(X^2/N)$

11. Determining causal interpretability of results – check if RA of individuals, IV manipulation and confound control
    a. Remember to check for counterbalancing of WG designs
    b. Remember that out-of-lab & longer studies have greater chances for ongoing equivalence problems

12. Evaluating "replication" of earlier results
    a. Be sure that operationalization of variables and design components for the two studies are "comparable"
    b. Compare results …
        - Effect sjze & pattern (r, mean difference or frequency pattern, as appropriate)
        - Significance of results (power analysis may be helpful if rs are similar but NHST results differ)

13. *A priori* power analsis for "next study" – use effect size estimate from current study and desired power to look up sample size
    a. S = N for study using ANOVA, N/2 = n in each condition
    b. S = N for study using r
    c. S = N for study using X^2 (divide into haves if one of the qual variables is an "IV")