

PSQF6270 Spring 2022 Homework #1

15 total points (8 from computations, 7 from results)

Due 2,14,2022

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This homework assignment focuses on a study conducted in the Department of Recreational Sciences at Midwestern State University designed to meet two objectives. First, the investigators wanted to examine the extent to which performance in miniature golf (mini-golf) could benefit from a new approach to skills training, as well as the extent to which training in related activities (i.e., regular golf) might differentially impact performance. To that end, 200 students were randomly assigned to one of four conditions: (1) control (usual mini-golf skills instruction), (2) new training for mini-golf only, (3) new training for regular-golf only, or (4) new training in both mini-golf and regular-golf. The outcome variable was **score**, the number of strokes taken on a high-stakes 18-hole game of mini-golf held at the end of training, in which **lower scores (fewer strokes) indicate better performance**.

Second, the investigators also wanted to examine the effects of experience with and enthusiasm for the sport of mini-golf. To that end, prior to beginning the training, participants indicated their previous amount of mini-golf experience on a 1-7 scale (treated as interval), and they also completed the Mini-Golf Enthusiasm Scale (MGES). The MGES has been shown in previous research to be a perfectly reliable measure of mini-golf enthusiasm whose items perfectly fit a one-factor model. Therefore, latent trait estimates (Mean~0, SD~1) derived from the MGES were used as an observed predictor variable, along with training group and experience.

Your task is to estimate the three general linear models specified below using SAS GLM, STATA REGRESS, or R LM. For the quantitative predictors, center experience at 4 and center enthusiasm at 0 (leave it uncentered). For the training group variable, use indicator dummy coding in which the control group is the reference. Specific estimates may be provided in the model or may need to be requested separately as linear combinations of model parameters. In each comparison question, the group listed BEFORE the vs. is the baseline for the comparison, such that the comparison reflects the effect of being in the group listed AFTER the vs. Direction will matter, so please keep this in mind.

Please note that some computational questions are for checking the model or for reinforcing concepts (indicated by {check}), whereas others serve those purposes but will also be reported in the results (indicated by {report}). If your residual variance is wrong, you do not have the correct predictor fixed effects in your model. If your fixed intercept is wrong, you do not have the correct predictor centering or coding in your model. All values to be entered are numeric and must be entered to the nearest **.01** to be correct. For the estimates, it may be helpful to enter as many digits as possible in order to help differentiate them later. In the results sections, question

numbers are provided in parentheses before each response for your reference. Use a cut-off of $p < .05$ as your indicator of significance.

Section 1 Computational Questions:

For section 1, estimate an empty model predicting mini-golf scores (the number of strokes taken).

Q1. {report} Enter the estimate for the residual variance **89.103**

Q2. {report} Enter the estimate for the fixed intercept **72.65**

Section 1 Results Questions:

The extent to which a new approach to skills training could improve performance in mini-golf was examined in a sample of 200 participants randomly assigned to four groups: control (treatment as usual for skills instruction), new training for mini-golf only, new training for regular-golf only, or new training in both mini-golf and regular golf (denoted as both-golf below). In addition, the impact of prior experience with and enthusiasm for the sport of mini-golf was also examined. To facilitate interpretation of the intercept and any simple main effect slopes, the predictor for mini-golf experience was centered at 4 (on a scale of 1-7) and the predictor for enthusiasm was left uncentered at 0 (near the mean of the Mini-Golf Enthusiasm Scale, or MGES). The outcome variable was the number of strokes taken on a high-stakes 18-hole game of mini-golf held at the end of training, in which **lower scores (fewer strokes) indicate better performance**. Three general linear models were estimated to answer the research questions, as described below.

First, an empty means model was estimated to provide a baseline, in which the fixed intercept of **72.65** indicated the (Q48) , and the residual variance of **89.103** indicated the (Q49) . Results from two conditional models (using a significance criterion of $p < .05$) are reported next.

Section 2 Computational Questions:

For section 2, estimate a conditional model that examines the extent to which training group and experience additively predict mini-golf scores after controlling for enthusiasm.

- Q3. {report} Enter the estimate for the residual variance **10.61**
- Q4. {check} Enter the estimate for the fixed intercept **75.05121**
- Q5. {report} Enter the R^2 for the proportion of variance accounted for by the model **0.88391**
- Q6. {report} Enter the F-value for the significance test of this model R^2 **295.42**
- Q7. {report} Enter the p-value for the significance test of this model R^2 **2.22E-16**
- Q8. {report} Enter the F-value for the significance test of the omnibus main effect of training group **219.19**
- Q9. {report} Enter the p-value for the significance test of the omnibus main effect of training group **4.7568E-62**
- Q10. {check} Enter the estimate for the fixed slope of experience **-2.73427**

Q11. {check} Enter the SE for the fixed slope of experience	0.16428
Q12. {check} Enter the estimate for the fixed slope of enthusiasm	-4.35585
Q13. {check} Enter the SE for the fixed slope of enthusiasm	0.20863

Section 2 Results Questions:

We then estimated a conditional model to examine the extent to which training group and prior experience additively predicted mini-golf score after controlling for prior enthusiasm. The model $R^2 = 0.88391$ was (Q50) significantly greater than 0, (Q51) $F(DFnum=5, DFden=194) = 295.42$, $MSE = 10.61$, $p < 2.22E-16$. As expected, there was a (Q52) significant omnibus mean difference across the four training groups, (Q53) $F(DFnum=3, DFden=194) = 219.19$, $p < 4.7568E-62$. In addition, participants with greater mini-golf experience had (Q54) significantly better mini-golf performance (Est = -2.73427, SE = 0.16428), and participants with greater mini-golf enthusiasm had (Q55) significantly better mini-golf performance (Est = -4.35585, SE = 0.20863).

Section 3 Computational Questions:

For section 3, estimate a new conditional model that examines the extent to which the effect of training group depends on prior experience with mini-golf.

Q14. {report} Enter the estimate for the residual variance	6.9865062
Q15. {check} Enter the estimate for the fixed intercept	75.028491
Q16. {report} Enter the R^2 for the proportion of variance accounted for by the model	0.92474
Q17. {report} Enter the F-value for the significance test of this model R^2	293.38
Q18. {report} Enter the p-value for the significance test of this model R^2	2.22E-16
Q19. {report} Enter the change in R^2 for the amount of explained variance relative to the previous model	0.04083
Q20. {report} Enter the F-value for the significance test of the omnibus interaction of training group by experience	34.546
Q21. {report} Enter the p-value for the significance test of the omnibus interaction of training group by experience	9.1179E-32
Q22. {report} Enter the estimate for the fixed slope of enthusiasm	-4.498956
Q23. {check} Enter the SE for the fixed slope of enthusiasm	0.17636
Q24. {report} Enter the estimate for the fixed slope of experience for control	-1.915598
Q25. {report} Enter the SE for the fixed slope of experience for control	0.255957
Q26. {report} Enter the estimate for the fixed slope of experience for mini-golf	-6.05242
Q27. {report} Enter the SE for the fixed slope of experience for mini-golf	0.36148
Q28. {report} Enter the estimate for the fixed slope of experience for regular-golf	-2.68988
Q29. {report} Enter the SE for the fixed slope of experience for regular-golf	0.23435
Q30. {report} Enter the estimate for the fixed slope of experience for both-golf	-1.96612

Q31. {report} Enter the SE for the fixed slope of experience for both-golf	0.25615
Q32. {report} Enter the estimate for the fixed slope of control vs. mini-golf for experience=4	-10.06888
Q33. {report} Enter the SE for the fixed slope of control vs. mini-golf for experience=4	0.54233
Q34. {report} Enter the estimate for the fixed slope of control vs. regular-golf for experience=4	5.41945
Q35. {report} Enter the SE for the fixed slope of control vs. regular-golf for experience=4	0.53549
Q36. {report} Enter the estimate for the fixed slope of mini-golf vs. both-golf for experience=4	5.32886
Q37. {report} Enter the SE for the fixed slope of mini-golf vs. both-golf for experience=4	0.52929
Q38. {report} Enter the estimate for the fixed slope of regular-golf vs. both-golf for experience=4	-10.15946
Q39. {report} Enter the SE for the fixed slope of regular-golf vs. both-golf for experience=4	0.52509
Q40. {report} Enter the estimate for the fixed slope for the interaction of experience by control vs. mini-golf	-4.13682
Q41. {report} Enter the SE for the fixed slope for the interaction of experience by control vs. mini-golf	0.44179
Q42. {report} Enter the estimate for the fixed slope for the interaction of experience by control vs. regular-golf	-0.77428
Q43. {report} Enter the SE for the fixed slope for the interaction of experience by control vs. regular-golf	0.3462
Q44. {report} Enter the estimate for the fixed slope for the interaction of experience by mini-golf vs. both-golf	4.0863
Q45. {report} Enter the SE for the fixed slope for the interaction of experience by mini-golf vs. both-golf	0.44416
Q46. {report} Enter the estimate for the fixed slope for the interaction of experience by regular-golf vs. both-golf	0.72376
Q47. {report} Enter the SE for the fixed slope for the interaction of experience by regular-golf vs. both-golf	0.34802

Section 3 Results Questions:

We then estimated a final conditional model to examine the extent to which the effects of training group depended on prior experience with mini-golf. This interaction model had an $R^2 = 0.92474$, which was (Q56) significantly greater than 0, (Q57) $F(DFnum=8, DFden=191) = 293.38$, $MSE = 6.9865062$, $p < 2.22E-16$. There was a (Q58) omnibus interaction of mini-golf experience by training group, (Q59) $F(DFnum=3, DFden=191) = 34.546$, $p < 9.1179E-32$, indicating a (Q60) significantly stronger R^2 by 0.04083 relative to the previous additive model. The interaction model results can be interpreted as follows.

First, the slope for the marginal main effect of enthusiasm indicated that a one-unit difference in enthusiasm was related to a score difference of $Est = -4.498956$ ($SE = 0.17636$), indicating that greater enthusiasm was related to (Q61) mini-golf performance.

Second, we examined the simple slopes of experience within each training group and the differences of these simple slopes across training groups in planned comparisons. Within the control group, a one-unit difference in experience was related to a score difference of $Est = -1.915598$ ($SE = 0.255957$), indicating that greater experience was related to (Q62) mini-golf performance for those who received traditional training (within the control group). In comparison, relative to the control group, the slope of

experience in the mini-golf-only training group was (Q63) **significantly stronger** (slope difference Est = **-4.13682**, SE = **0.44179**), resulting in a (Q64) **significantly negative** slope of experience within the mini-golf-only training group (Est = **-6.05242**, SE = **0.36148**). Also in comparison to the control group, the effect of experience in the regular-golf-only training group was (Q65) **significantly stronger** (slope difference Est = **-0.77428**, SE = **0.3462**), resulting in a (Q66) **significantly negative** slope of experience within the regular-golf-only training group (Est = **-2.68988**, SE = **0.23435**).

Third, we compared the slope of experience across the three groups receiving new training. In comparison to the mini-golf-only training group, the slope of experience in the both-golf training group was (Q67) **significantly weaker** (slope difference Est = **4.0863**, SE = **0.44416**), resulting in a (Q68) **significantly negative** slope of experience within the both-golf training group (Est = **-1.96612**, SE = **0.25615**). Likewise, in comparison to the regular-golf-only training group, the slope of experience in the both-golf training group was (Q69) **significantly weaker** (slope difference Est = **0.72376**, SE = **0.34802**).

Fourth, we considered the simple main effects for differences between training group as evaluated conditionally for persons with prior mini-golf experience = 4, along with the extent to which experience moderated each training group difference. Let us first consider the effectiveness of each training relative to control. The simple main effect of mini-golf-only relative to control (at experience=4) of Est = **-10.06888** (SE = **0.54233**) indicated that the mini-golf-only training group performed (Q70) **significantly better** than the control group. This group difference for control vs mini-golf was (Q71) **significantly stronger** for persons with greater experience. The simple main effect of regular-golf-only relative to control (at experience=4) of Est = **5.41945** (SE = **0.53549**) indicated that the regular-golf-only training group performed (Q72) **significantly worse** than the control group. This group difference for control vs regular-golf was (Q73) **significantly weaker** for persons with greater experience.

Finally, we examined the incremental training effects of regular-golf training and of mini-golf training above and beyond the other type of training. The simple main effect of both-golf relative to mini-golf-only (at experience=4) of Est = **5.32886** (SE = **0.52929**) indicated that the both-golf training group performed (Q74) **significantly worse** than the mini-golf-only group. This group difference for mini-golf-only vs both-golf was (Q75) **significantly weaker** for persons with greater experience. The simple main effect of both-golf relative to regular-golf (at experience=4) of Est = **-10.15946** (SE = **0.52509**) indicated that the both-golf training group performed (Q76) **significantly better** than the regular-golf-only group. This group difference for regular-golf-only vs both-golf was (Q77) **significantly weaker** for persons with greater experience.

Check and Save Your Answers

Good work! All computational questions are now correct. However, your answers to the other questions will not be graded until you submit your final answers. So please make sure to submit your final answers once you are finished.

Submit *FINAL* answers

You only get one chance to submit your final answers for a grade.
You may see your final grade only after the due date has passed.

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