Homework 3\_4

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## Loading Data

library(tidyverse)  
library(lavaan)  
library(lavaanPlot)  
  
hw <- rio::import(here::here('data', 'hw4\_achievement.csv'),  
 setclass = 'tbl\_df') %>%   
 janitor::clean\_names()

psych::describe(hw, na.rm = TRUE)

## vars n mean sd median trimmed mad min max range skew  
## study\_id 1 273 137.00 78.95 137.00 137.00 100.82 1.00 273 272.00 0.00  
## girl 2 272 0.48 0.50 0.00 0.47 0.00 0.00 1 1.00 0.09  
## efficacy 3 267 5.72 2.41 5.67 5.73 2.83 1.00 10 9.00 -0.06  
## bullying 4 271 5.07 2.85 5.00 5.06 3.96 0.67 10 9.33 0.01  
## achieve\_t 5 270 63.74 7.87 62.00 63.35 8.90 50.00 81 31.00 0.40  
## kurtosis se  
## study\_id -1.21 4.78  
## girl -2.00 0.03  
## efficacy -1.02 0.15  
## bullying -1.36 0.17  
## achieve\_t -0.87 0.48

hw2 <- hw %>%   
 mutate(efficacy\_z = scale(efficacy, center = TRUE, scale = TRUE),  
 bullying\_z = scale(bullying, center = TRUE, scale = TRUE),  
 eff\_x\_bull = efficacy\_z\*bullying\_z,  
 bully\_minus = bullying\_z - 1,  
 bully\_plus = bullying\_z + 1)  
  
model <- lm(achieve\_t ~ efficacy\_z\*bullying\_z + girl, data = hw2)  
summary(model)

##   
## Call:  
## lm(formula = achieve\_t ~ efficacy\_z \* bullying\_z + girl, data = hw2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -14.9410 -4.1893 -0.3146 3.9260 16.9109   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 63.0203 0.5099 123.586 < 2e-16 \*\*\*  
## efficacy\_z 3.1444 0.3751 8.383 3.48e-15 \*\*\*  
## bullying\_z -3.3765 0.3725 -9.064 < 2e-16 \*\*\*  
## girl 1.2047 0.7314 1.647 0.101   
## efficacy\_z:bullying\_z -1.8713 0.3627 -5.159 4.98e-07 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 5.856 on 256 degrees of freedom  
## (12 observations deleted due to missingness)  
## Multiple R-squared: 0.4488, Adjusted R-squared: 0.4402   
## F-statistic: 52.12 on 4 and 256 DF, p-value: < 2.2e-16

minus <- lm(achieve\_t ~ efficacy\_z\*bully\_minus + girl, data = hw2)  
summary(minus)

##   
## Call:  
## lm(formula = achieve\_t ~ efficacy\_z \* bully\_minus + girl, data = hw2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -14.9410 -4.1893 -0.3146 3.9260 16.9109   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 59.6438 0.6469 92.195 < 2e-16 \*\*\*  
## efficacy\_z 1.2732 0.4801 2.652 0.00851 \*\*   
## bully\_minus -3.3765 0.3725 -9.064 < 2e-16 \*\*\*  
## girl 1.2047 0.7314 1.647 0.10076   
## efficacy\_z:bully\_minus -1.8713 0.3627 -5.159 4.98e-07 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 5.856 on 256 degrees of freedom  
## (12 observations deleted due to missingness)  
## Multiple R-squared: 0.4488, Adjusted R-squared: 0.4402   
## F-statistic: 52.12 on 4 and 256 DF, p-value: < 2.2e-16

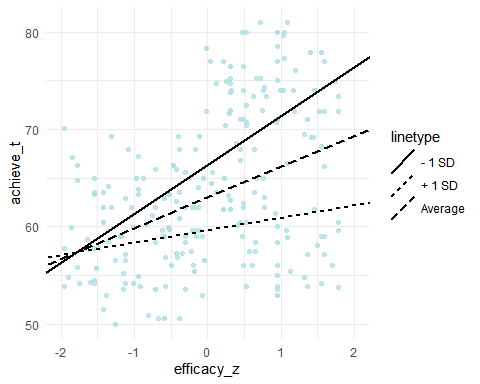
plus <- lm(achieve\_t ~ efficacy\_z\*bully\_plus + girl, data = hw2)  
summary(plus)

##   
## Call:  
## lm(formula = achieve\_t ~ efficacy\_z \* bully\_plus + girl, data = hw2)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -14.9410 -4.1893 -0.3146 3.9260 16.9109   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 66.3968 0.6157 107.841 < 2e-16 \*\*\*  
## efficacy\_z 5.0157 0.5604 8.951 < 2e-16 \*\*\*  
## bully\_plus -3.3765 0.3725 -9.064 < 2e-16 \*\*\*  
## girl 1.2047 0.7314 1.647 0.101   
## efficacy\_z:bully\_plus -1.8713 0.3627 -5.159 4.98e-07 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 5.856 on 256 degrees of freedom  
## (12 observations deleted due to missingness)  
## Multiple R-squared: 0.4488, Adjusted R-squared: 0.4402   
## F-statistic: 52.12 on 4 and 256 DF, p-value: < 2.2e-16

lav\_mod <- '  
# regression  
achieve\_t ~ efficacy\_z + bullying\_z + eff\_x\_bull + girl  
'  
  
lav\_fit <- sem(lav\_mod, data = hw2)  
summary(lav\_fit, standardized = TRUE)

## lavaan 0.6-11 ended normally after 1 iterations  
##   
## Estimator ML  
## Optimization method NLMINB  
## Number of model parameters 5  
##   
## Used Total  
## Number of observations 261 273  
##   
## Model Test User Model:  
##   
## Test statistic 0.000  
## Degrees of freedom 0  
##   
## Parameter Estimates:  
##   
## Standard errors Standard  
## Information Expected  
## Information saturated (h1) model Structured  
##   
## Regressions:  
## Estimate Std.Err z-value P(>|z|) Std.lv Std.all  
## achieve\_t ~   
## efficacy\_z 3.144 0.371 8.464 0.000 3.144 0.400  
## bullying\_z -3.376 0.369 -9.152 0.000 -3.376 -0.429  
## eff\_x\_bull -1.871 0.359 -5.209 0.000 -1.871 -0.243  
## girl 1.205 0.724 1.663 0.096 1.205 0.077  
##   
## Variances:  
## Estimate Std.Err z-value P(>|z|) Std.lv Std.all  
## .achieve\_t 33.631 2.944 11.424 0.000 33.631 0.551

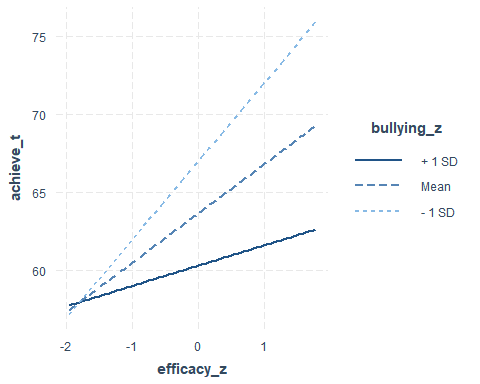
minus\_eff <- minus[['coefficients']]['efficacy\_z']  
avg\_eff <- model[['coefficients']]['efficacy\_z']  
plus\_eff <- plus[['coefficients']]['efficacy\_z']  
  
hw2 %>%  
 ggplot(aes(efficacy\_z, achieve\_t)) +  
 geom\_point(alpha = .8, color = 'powderblue') +  
 geom\_abline(aes(linetype = '+ 1 SD', slope = minus\_eff, intercept = 59.64), size = 1) +  
 geom\_abline(aes(linetype = 'Average', slope = avg\_eff, intercept = 63.02), size = 1) +  
 geom\_abline(aes(linetype = '- 1 SD', slope = plus\_eff, intercept = 66.40), size = 1) +  
 xlim(-2, 2) +  
 theme\_minimal()



## Plotting Interaction

library(probemod)  
  
interactions::probe\_interaction(model = model, pred = efficacy\_z, modx = bullying\_z)

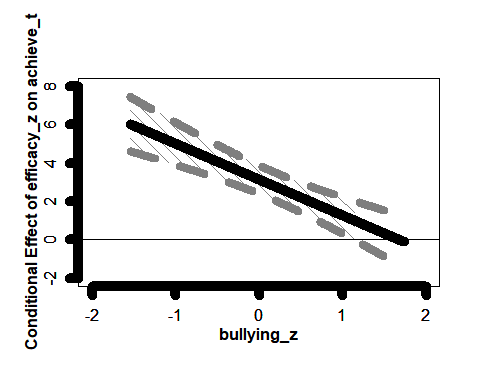
## JOHNSON-NEYMAN INTERVAL   
##   
## When bullying\_z is OUTSIDE the interval [1.14, 2.74], the slope of  
## efficacy\_z is p < .05.  
##   
## Note: The range of observed values of bullying\_z is [-1.55, 1.73]  
##   
## SIMPLE SLOPES ANALYSIS   
##   
## Slope of efficacy\_z when bullying\_z = -1.00477670 (- 1 SD):   
##   
## Est. S.E. t val. p  
## ------ ------ -------- ------  
## 5.02 0.56 8.95 0.00  
##   
## Slope of efficacy\_z when bullying\_z = -0.01079277 (Mean):   
##   
## Est. S.E. t val. p  
## ------ ------ -------- ------  
## 3.16 0.38 8.42 0.00  
##   
## Slope of efficacy\_z when bullying\_z = 0.98319116 (+ 1 SD):   
##   
## Est. S.E. t val. p  
## ------ ------ -------- ------  
## 1.30 0.48 2.74 0.01



jnresults <- jn(model, dv = 'achieve\_t', iv = 'efficacy\_z', mod = 'bullying\_z', alpha = .05)  
  
jnresults

## Call:  
## jn(model = model, dv = "achieve\_t", iv = "efficacy\_z", mod = "bullying\_z",   
## alpha = 0.05)  
##   
## Conditional effects of efficacy\_z on achieve\_t at values of bullying\_z   
## bullying\_z Effect se t p llci ulci  
## 1 1.2732 0.4801 2.6517 0.0085 0.3276 2.2187  
## 2 -0.5981 0.7639 -0.7830 0.4344 -2.1024 0.9062  
## 3 -2.4694 1.0953 -2.2546 0.0250 -4.6263 -0.3124  
## 4 -4.3407 1.4418 -3.0105 0.0029 -7.1801 -1.5012

plot(jnresults)



## Values of bullying\_z indicated by the shaded region  
## x y se t p llci  
## Lower Bound: 1.139631 1.011873 0.5138209 1.969311 0.05 6.661338e-16  
## Upper Bound: 2.740264 -1.983355 1.0071314 -1.969311 0.05 -3.966709e+00  
## ulci  
## Lower Bound: 2.023746e+00  
## Upper Bound: 2.220446e-16

## Answers

My hypothesis is:

Higher levels of school bullying will moderate the impact of self-efficacy on achievement. Such that, higher levels of bullying will erode the beneficial effect of efficacy on achievement.

Answer:

The hypothesis was supported as bullying moderated the association between efficacy and achievement (b = -1.87, p < .001). The simple slopes showed that at all levels of bullying, the association between efficacy and achievement was significant. At high levels of bullying (-1 SD), self-efficacy was significantly associated with achievement (b = 5.02, p < .01). At low levels of bullying (+1 SD), self-efficacy was significantly associated with achievement (p < .001). The association was strongest for those that had lower levels of bullying. The regions of significance was within a lower bound of (6.66e-16, 2.02) and an upper bound of (-3.97, 2.20e-16).