Proposal EDA

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```
#install.packages('haven')
library(haven)
sesame <- read_dta("sesame.dta")
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.3.6      v purrr   0.3.4
## v tibble  3.1.8      v dplyr   1.0.10
## v tidyr   1.2.1      v stringr 1.4.1
## v readr   2.1.2      v forcats 0.5.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(knitr)
library(broom)
```

```
head(sesame)
```

```
## # A tibble: 6 x 28
##   rowna~1    id  site   sex   age viewcat setting viewenc prebody prelet preform
##     <dbl> <dbl> <dbl> <dbl> <dbl>   <dbl>   <dbl>   <dbl>   <dbl>  <dbl>   <dbl>
## 1       1     1     1     1    66       1       2       1      16     23      12
## 2       2     2     1     2    67       3       2       1      30     26       9
## 3       3     3     1     1    56       3       2       2      22     14       9
## 4       4     4     1     1    49       1       2       2      23     11      10
## 5       5     5     1     1    69       4       2       2      32     47      15
## 6       6     6     1     2    54       3       2       2      29     26      10
## # ... with 17 more variables: prenumb <dbl>, prerelat <dbl>, preclasf <dbl>,
## #   postbody <dbl>, postlet <dbl>, postform <dbl>, postnumb <dbl>,
## #   postrelat <dbl>, postclasf <dbl>, peabody <dbl>, agecat <dbl>,
## #   encour <dbl>, `_Isite_2` <dbl>, `_Isite_3` <dbl>, `_Isite_4` <dbl>,
## #   `_Isite_5` <dbl>, regular <dbl>, and abbreviated variable name 1: rownames
```

Data Cleaning + Super Basic Stats

```
#sesame 1 i'm using for gams
sesame <- sesame %>%
```

```
  mutate(viewcat = as.factor(viewcat)) %>%
  mutate(site = as.factor(site)) %>%
  mutate(sex = as.factor(sex)) %>%
  mutate(setting = as.factor(setting)) %>%
  mutate(viewenc = as.factor(viewenc)) %>%
  mutate(regular = as.factor(regular))
sesame1<- sesame
sesame1 <- sesame1 %>%
  mutate(difflet = postlet - prelet) %>%
  mutate(diffnumb = postnumb - prenumb)
```

```
levels(sesame$site) <- c("Disadv City", "Adv Sub", "Adv Rural", "Disadv Rural", "Disadv Spanish")
```

```
sesame <- sesame %>%
  mutate(diffbody = postbody - prebody) %>%
  mutate(difflet = postlet - prelet) %>%
  mutate(diffform = postform - preform) %>%
  mutate(diffnumb = postnumb - prenumb) %>%
  mutate(diffrelat = postrelat - prerelat) %>%
  mutate(diffclasf = postclasf - preclasf)
```

```
sesame %>%
  group_by(site) %>%
  count()
```

```
## # A tibble: 5 x 2
## # Groups:   site [5]
##   site               n
##   <fct>          <int>
## 1 Disadv City       60
## 2 Adv Sub           55
## 3 Adv Rural         64
## 4 Disadv Rural      43
## 5 Disadv Spanish    18
```

```
sesame %>%
  group_by(site) %>%
  count(encour)
```

```
## # A tibble: 10 x 3
## # Groups:   site [5]
##    site           encour     n
##    <fct>           <dbl> <int>
##  1 Disadv City         0    28
##  2 Disadv City         1    32
##  3 Adv Sub             0    19
##  4 Adv Sub             1    36
##  5 Adv Rural           0    14
##  6 Adv Rural           1    50
##  7 Disadv Rural        0    23
##  8 Disadv Rural        1    20
##  9 Disadv Spanish      0     4
## 10 Disadv Spanish      1    14
```

```
sesame %>%
  group_by(viewcat) %>%
  count(encour)
```

```
## # A tibble: 8 x 3
## # Groups:   viewcat [4]
##   viewcat encour     n
##   <fct>    <dbl> <int>
## 1 1            0    40
## 2 1            1    14
## 3 2            0    13
## 4 2            1    47
## 5 3            0    17
## 6 3            1    47
## 7 4            0    18
## 8 4            1    44
```

Question 1: Does watching sesame street impact learning?

```
#Created models to look for effects of being in different viewing categories on learning across categor

lm_body <- lm(diffbody ~ viewcat, data = sesame)
lm_let <- lm(difflet ~ viewcat, data = sesame)
lm_form <- lm(diffform ~ viewcat, data = sesame)
lm_numb <- lm(diffnumb ~ viewcat, data = sesame)
lm_relat <- lm(diffrelat ~ viewcat, data = sesame)
lm_clasf <- lm(diffclasf ~ viewcat, data = sesame)
summary(lm_body)
```

```
##
## Call:
## lm(formula = diffbody ~ viewcat, data = sesame)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.7833  -3.2460  -0.3253   3.2915  19.0938
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.1667     0.6918   4.578 7.61e-06 ***
## viewcat2      0.6167     0.9535   0.647    0.518
## viewcat3      0.7396     0.9393   0.787    0.432
## viewcat4      1.3172     0.9462   1.392    0.165
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.083 on 236 degrees of freedom
## Multiple R-squared:  0.008225,   Adjusted R-squared:  -0.004382
## F-statistic: 0.6524 on 3 and 236 DF,  p-value: 0.5822
```

```
summary(lm_let)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -37.000  -6.383  -0.741   5.519  27.650
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.481      1.339   1.853  0.06507 .
## viewcat2       5.869      1.846   3.180  0.00167 **
## viewcat3      12.519      1.818   6.886 5.15e-11 ***
## viewcat4      13.615      1.831   7.435 1.93e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.839 on 236 degrees of freedom
## Multiple R-squared:  0.2337, Adjusted R-squared:  0.2239
## F-statistic: 23.99 on 3 and 236 DF,  p-value: 1.386e-13
```

```
summary(lm_form)
```

```
##
## Call:
## lm(formula = diffform ~ viewcat, data = sesame)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -13.6333  -2.6333   0.1935   2.2222  13.1094
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.7778     0.5037   5.515 9.14e-08 ***
## viewcat2      0.8556     0.6943   1.232  0.21907
## viewcat3      1.1128     0.6839   1.627  0.10504
## viewcat4      2.0287     0.6890   2.945  0.00356 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.701 on 236 degrees of freedom
## Multiple R-squared:  0.03618,    Adjusted R-squared:  0.02393
## F-statistic: 2.953 on 3 and 236 DF,  p-value: 0.03331
```

```
summary(lm_numb)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat, data = sesame)
```

```
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -45.906  -5.671   0.000   6.407  24.550
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.593      1.272   3.611 0.000372 ***
## viewcat2       3.857      1.753   2.200 0.028750 *
## viewcat3       6.314      1.727   3.656 0.000316 ***
## viewcat4       7.407      1.740   4.258 2.98e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.346 on 236 degrees of freedom
## Multiple R-squared:  0.08244,    Adjusted R-squared:  0.07077
## F-statistic: 7.068 on 3 and 236 DF,  p-value: 0.0001439
```

```
summary(lm_relat)
```

```
##
## Call:
## lm(formula = diffrelat ~ viewcat, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.167  -2.167   0.375   1.833  11.833
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.1667     0.4708   2.478   0.0139 *
## viewcat2      0.3667     0.6489   0.565   0.5726
## viewcat3      0.4583     0.6393   0.717   0.4741
## viewcat4      1.3978     0.6440   2.171   0.0310 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.46 on 236 degrees of freedom
## Multiple R-squared:  0.02192,    Adjusted R-squared:  0.009488
## F-statistic: 1.763 on 3 and 236 DF,  p-value: 0.1549
```

```
summary(lm_clasf)
```

```
##
## Call:
## lm(formula = diffclasf ~ viewcat, data = sesame)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -10.8594  -3.0926   0.1406   2.6833  10.1406
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)   2.0926     0.6014   3.480 0.000598 ***
## viewcat2      1.2241     0.8289   1.477 0.141083
## viewcat3      1.7668     0.8166   2.164 0.031490 *
## viewcat4      2.4558     0.8226   2.986 0.003129 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.419 on 236 degrees of freedom
## Multiple R-squared:  0.03867,    Adjusted R-squared:  0.02645
## F-statistic: 3.164 on 3 and 236 DF,  p-value: 0.02524
```

```
# Mean in difference in each of these scores by view category. can skip for analysis
sesame %>%
  group_by(viewcat) %>%
  summarise(mean = mean(diffbody))
```

```
## # A tibble: 4 x 2
##   viewcat  mean
##   <fct>   <dbl>
## 1 1        3.17
## 2 2        3.78
## 3 3        3.91
## 4 4        4.48
```

```
sesame %>%
  group_by(viewcat) %>%
  summarise(mean = mean(difflet))
```

```
## # A tibble: 4 x 2
##   viewcat  mean
##   <fct>   <dbl>
## 1 1        2.48
## 2 2        8.35
## 3 3       15
## 4 4       16.1
```

```
sesame %>%
  group_by(viewcat) %>%
  summarise(mean = mean(diffform))
```

```
## # A tibble: 4 x 2
##   viewcat  mean
##   <fct>   <dbl>
## 1 1        2.78
## 2 2        3.63
## 3 3        3.89
## 4 4        4.81
```

```
sesame %>%
  group_by(viewcat) %>%
  summarise(mean = mean(diffnumb))
```

```
## # A tibble: 4 x 2
##   viewcat  mean
##   <fct>   <dbl>
## 1 1        4.59
## 2 2        8.45
## 3 3       10.9
## 4 4       12
```

```
sesame %>%
  group_by(viewcat) %>%
  summarise(mean = mean(diffrelat))
```

```
## # A tibble: 4 x 2
##   viewcat  mean
##   <fct>   <dbl>
## 1 1        1.17
## 2 2        1.53
## 3 3        1.62
## 4 4        2.56
```

```
sesame %>%
  group_by(viewcat) %>%
  summarise(mean = mean(diffclasf))
```

```
## # A tibble: 4 x 2
##   viewcat  mean
##   <fct>   <dbl>
## 1 1        2.09
## 2 2        3.32
## 3 3        3.86
## 4 4        4.55
```

```
#see what happens using regular instead of viewcat. still strongly significant for difflet and diffnumb
lm_let_reg <- lm(difflet ~ regular, data = sesame)
lm_numb_reg <- lm(diffnumb ~ regular, data = sesame)
lm_body_reg <- lm(diffbody ~ regular, data = sesame)
lm_form_reg <- lm(diffform ~ regular, data = sesame)
lm_relat_reg <- lm(diffrelat ~ regular, data = sesame)
lm_clasf_reg <- lm(diffclasf ~ regular, data = sesame)
summary(lm_body_reg)
```

```
##
## Call:
## lm(formula = diffbody ~ regular, data = sesame)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.0591  -3.0860  -0.0591   3.1640  18.9409
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.1667     0.6898   4.590 7.16e-06 ***
```

```
## regular1      0.8925     0.7836   1.139    0.256
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.069 on 238 degrees of freedom
## Multiple R-squared:  0.005421,   Adjusted R-squared:  0.001242
## F-statistic: 1.297 on 1 and 238 DF,  p-value: 0.2559
```

```
summary(lm_let_reg)
```

```
##
## Call:
## lm(formula = difflet ~ regular, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -35.220  -7.220  -1.481   5.584  27.780
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.481      1.394   1.780   0.0764 .
## regular1      10.739      1.584   6.781 9.37e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.25 on 238 degrees of freedom
## Multiple R-squared:  0.1619, Adjusted R-squared:  0.1584
## F-statistic: 45.98 on 1 and 238 DF,  p-value: 9.366e-11
```

```
summary(lm_form_reg)
```

```
##
## Call:
## lm(formula = diffform ~ regular, data = sesame)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.1129  -2.1129  -0.1129   2.2222  12.8871
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.7778     0.5052   5.499 9.85e-08 ***
## regular1      1.3351     0.5738   2.327   0.0208 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.712 on 238 degrees of freedom
## Multiple R-squared:  0.02224,    Adjusted R-squared:  0.01813
## F-statistic: 5.413 on 1 and 238 DF,  p-value: 0.02083
```

```
summary(lm_numb_reg)
```

```
##
## Call:
## lm(formula = diffnumb ~ regular, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -45.478  -5.814   0.407   6.407  22.522
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.593      1.279   3.591 0.000399 ***
## regular1       5.886      1.453   4.052 6.88e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.397 on 238 degrees of freedom
## Multiple R-squared:  0.06454,    Adjusted R-squared:  0.06061
## F-statistic: 16.42 on 1 and 238 DF,  p-value: 6.876e-05
```

```
summary(lm_relat_reg)
```

```
##
## Call:
## lm(formula = diffrelat ~ regular, data = sesame)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11.1667  -1.9086   0.0914   2.0914  11.8333
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.1667     0.4721   2.471   0.0142 *
## regular1      0.7419     0.5363   1.383   0.1678
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.47 on 238 degrees of freedom
## Multiple R-squared:  0.007977,   Adjusted R-squared:  0.003809
## F-statistic: 1.914 on 1 and 238 DF,  p-value: 0.1678
```

```
summary(lm_clasf_reg)
```

```
##
## Call:
## lm(formula = diffclasf ~ regular, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -10.914  -2.914   0.086   3.086  10.086
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.0926     0.6018   3.477 0.000603 ***
```

```
## regular1      1.8214     0.6836   2.664 0.008244 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.423 on 238 degrees of freedom
## Multiple R-squared:  0.02896,    Adjusted R-squared:  0.02488
## F-statistic: 7.098 on 1 and 238 DF,  p-value: 0.008244
```

```
#Decided to focus in on variables with two strongest effects, and see whether those effects still held

#Is there anything else we have to do to show that sesame street generally was associated with increase

lm_let <- lm(difflet ~ viewcat + sex + age + setting + + prelet + site, data = sesame)
lm_numb <- lm(diffnumb ~ viewcat + sex + age + setting + + prenumb + site, data = sesame)

summary(lm_let)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + sex + age + setting + +prelet +
##     site, data = sesame)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -28.2064  -5.6284  -0.2192   5.3259  21.4166
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -5.9873     4.9980  -1.198 0.232186
## viewcat2             5.8084     1.6945   3.428 0.000722 ***
## viewcat3            12.1372     1.7418   6.968 3.42e-11 ***
## viewcat4            12.5065     1.7748   7.047 2.15e-11 ***
## sex2                 1.0614     1.1319   0.938 0.349386
## age                  0.2717     0.1002   2.712 0.007206 **
## setting2             0.1724     1.2900   0.134 0.893826
## prelet              -0.3788     0.0732  -5.175 5.00e-07 ***
## siteAdv Sub          7.4776     1.6485   4.536 9.27e-06 ***
## siteAdv Rural       -5.2865     1.6468  -3.210 0.001518 **
## siteDisadv Rural    -0.7470     1.8490  -0.404 0.686577
## siteDisadv Spanish   1.5424     2.4938   0.619 0.536852
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.658 on 228 degrees of freedom
## Multiple R-squared:  0.4267, Adjusted R-squared:  0.3991
## F-statistic: 15.43 on 11 and 228 DF,  p-value: < 2.2e-16
```

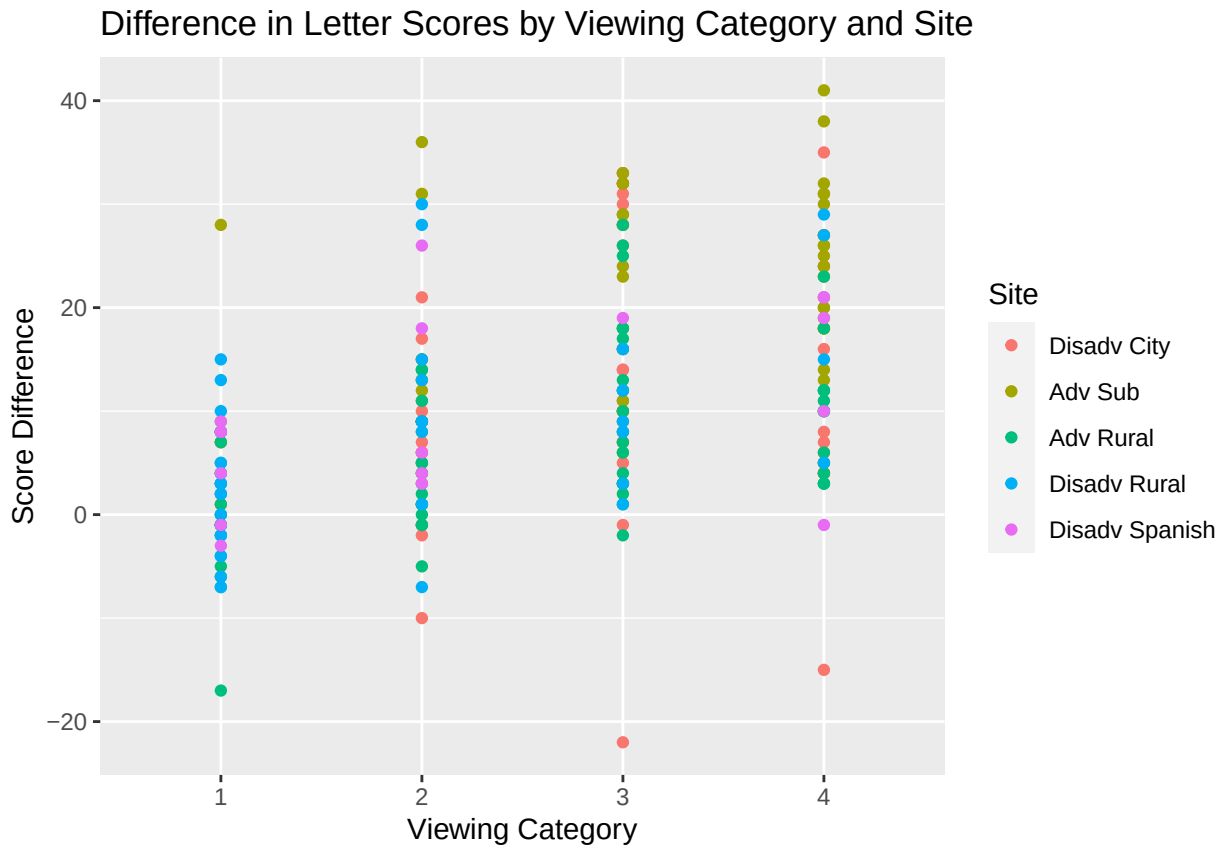
```
summary(lm_numb)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + sex + age + setting + +prenumb +
##     site, data = sesame)
```

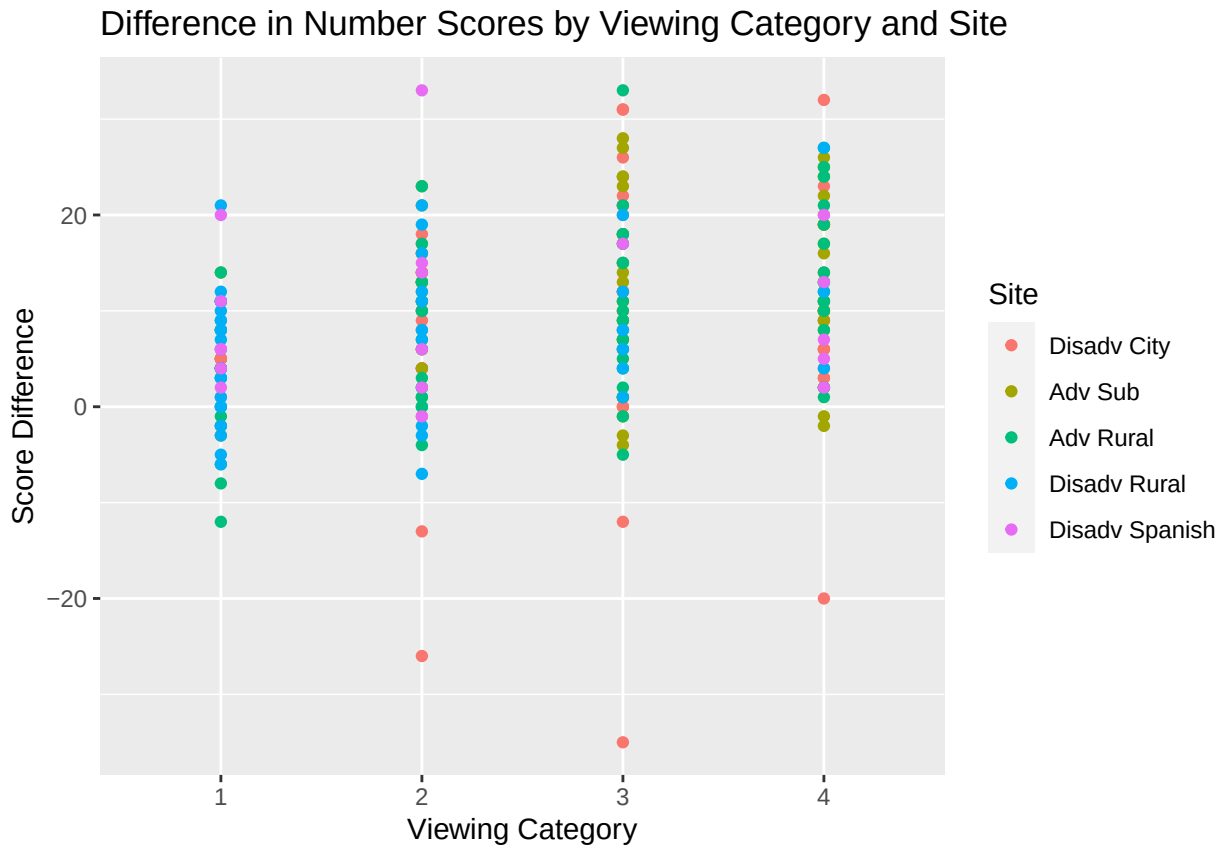
```
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -33.222  -5.345   0.101   5.788  21.250
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -1.64267    5.13107  -0.320  0.74915
## viewcat2            4.87825    1.69565   2.877  0.00440 **
## viewcat3            8.29293    1.75548   4.724 4.04e-06 ***
## viewcat4            9.22375    1.79041   5.152 5.58e-07 ***
## sex2                0.69555    1.13043   0.615  0.53897
## age                 0.21322    0.10719   1.989  0.04788 *
## setting2            1.85877    1.28264   1.449  0.14866
## prenumb            -0.40162    0.06473  -6.205 2.55e-09 ***
## siteAdv Sub         5.00316    1.65403   3.025  0.00277 **
## siteAdv Rural      -0.84254    1.66932  -0.505  0.61424
## siteDisadv Rural    0.12581    1.84263   0.068  0.94563
## siteDisadv Spanish  4.19485    2.49180   1.683  0.09365 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.644 on 228 degrees of freedom
## Multiple R-squared:  0.2417, Adjusted R-squared:  0.2051
## F-statistic: 6.605 on 11 and 228 DF,  p-value: 1.47e-09
```

Question 2: How did the benefits of watching sesame street vary across demographic groups?

```
#Continuing focus on difflet and diffnumb, these graphs show how learning varied depending on how much

ggplot(data = sesame, mapping = aes(x = viewcat, y = difflet, color = site)) +
  geom_point() +
  labs(title = "Difference in Letter Scores by Viewing Category and Site",
       x = "Viewing Category", y = "Score Difference", color = "Site")
```



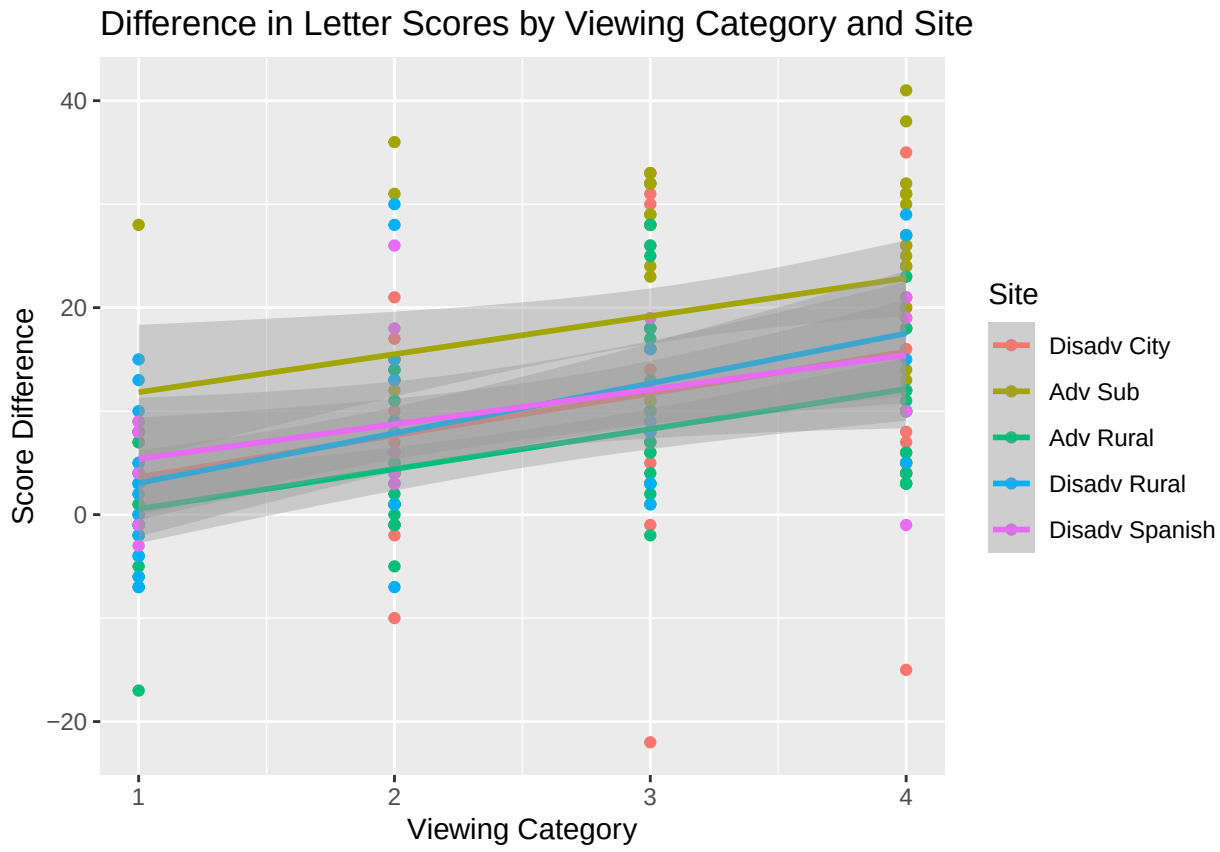

```
ggplot(data = sesame, mapping = aes(x = viewcat, y = diffnumb, color = site)) +
  geom_point() +
  labs(title = "Difference in Number Scores by Viewing Category and Site",
       x = "Viewing Category", y = "Score Difference", color = "Site")
```




```
#Just made these graphs and I really like them. They confirm the general point that there isn't really
```

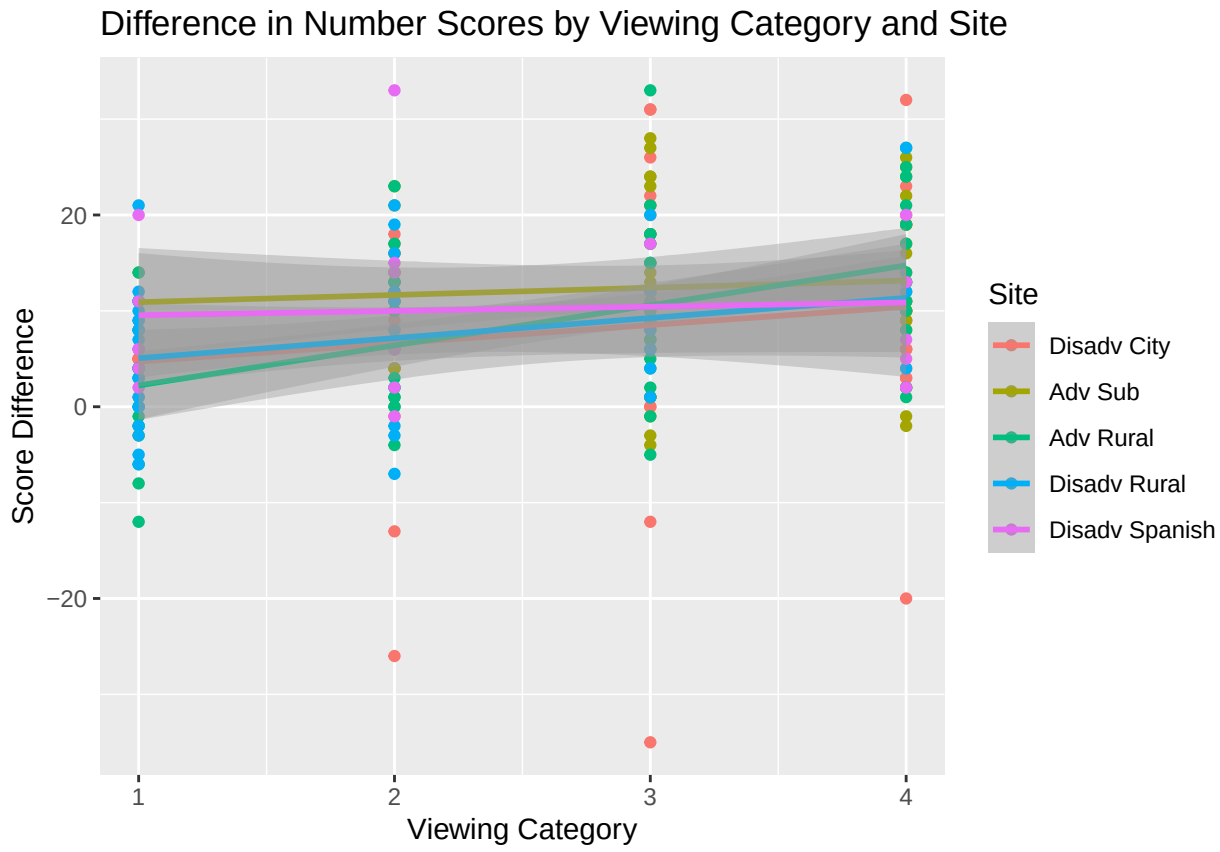
```
library(ggplot2)
qplot(x = as.numeric(viewcat), y = difflet, data = sesame, color = site) +
  geom_smooth(method = "lm") + labs(title = "") +
  labs(title = "Difference in Letter Scores by Viewing Category and Site",
       x = "Viewing Category", y = "Score Difference", color = "Site")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



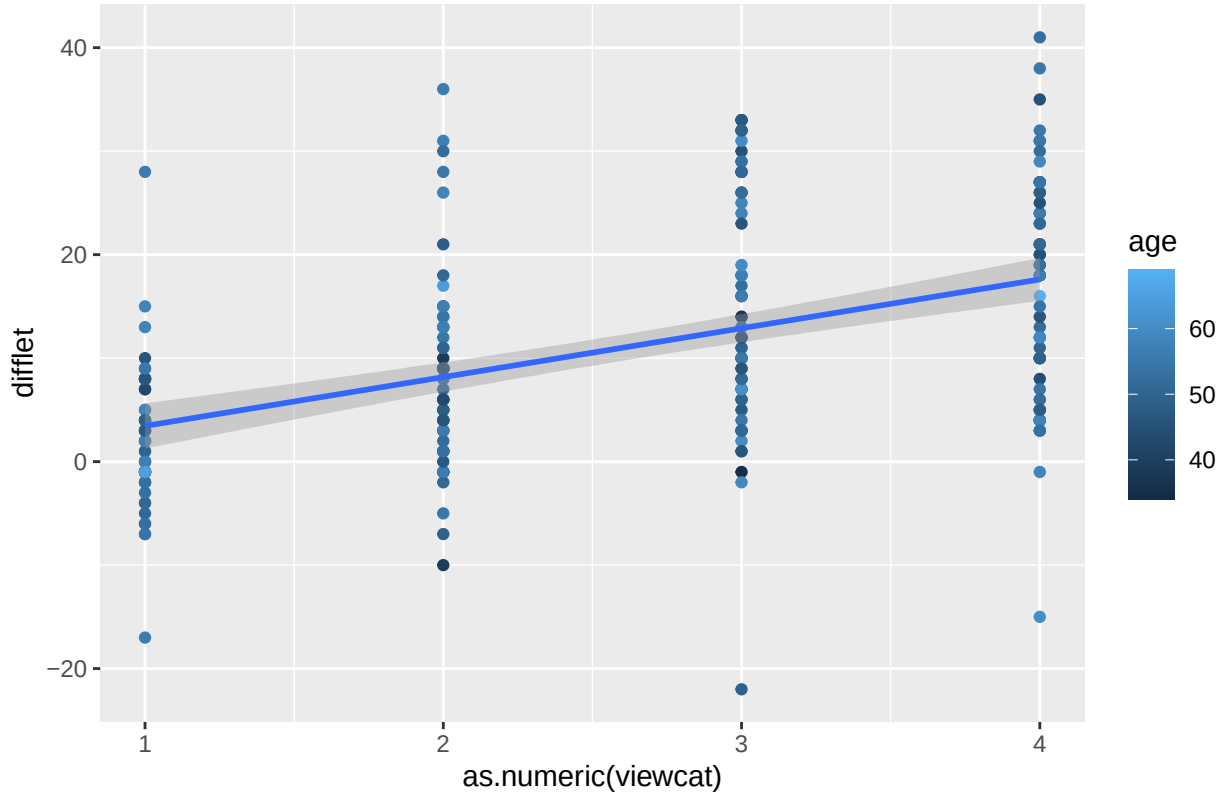

```
qplot(x = as.numeric(viewcat), y = diffnumb, data = sesame, color = site) +
  geom_smooth(method = "lm") +
  labs(title = "Difference in Number Scores by Viewing Category and Site",
       x = "Viewing Category", y = "Score Difference", color = "Site")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



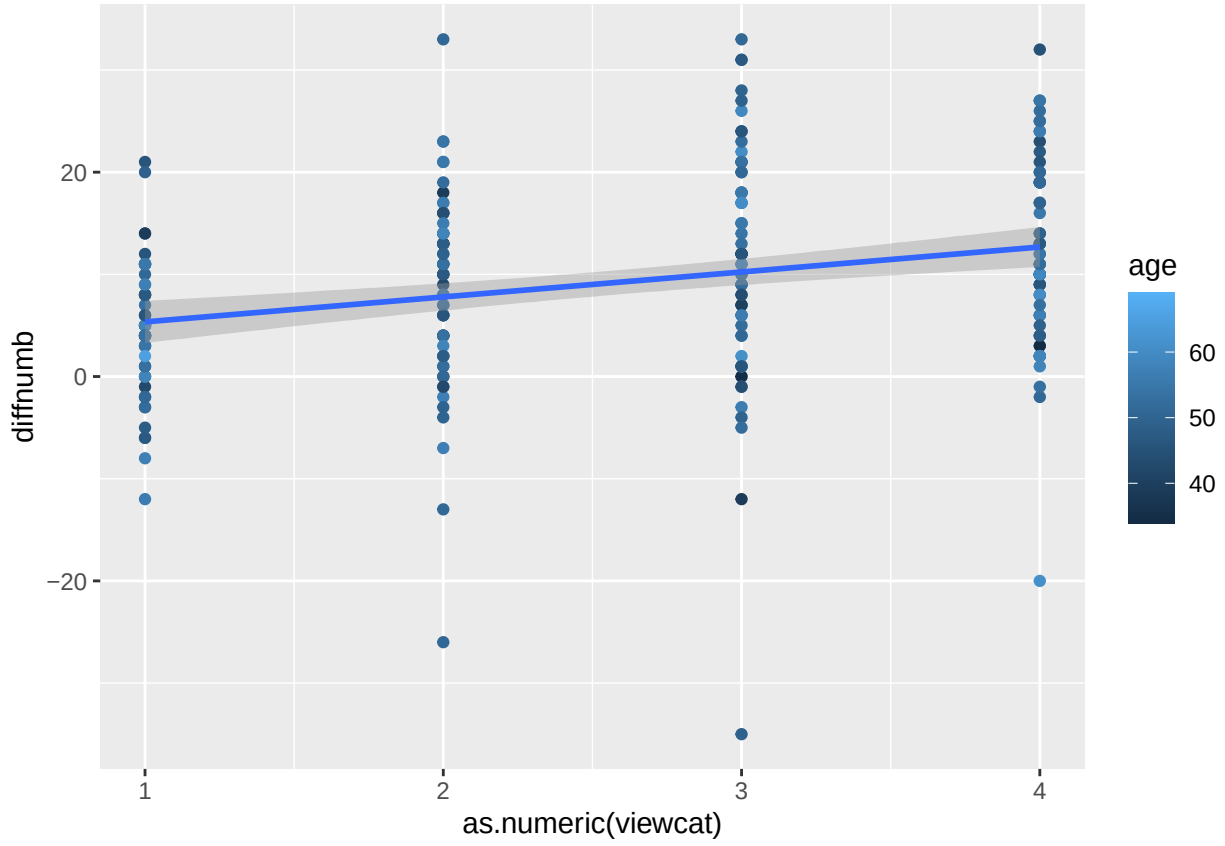

```
qplot(x = as.numeric(viewcat), y = difflet, data = sesame, color = age) +
  geom_smooth(method = "lm") + labs(title = "")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



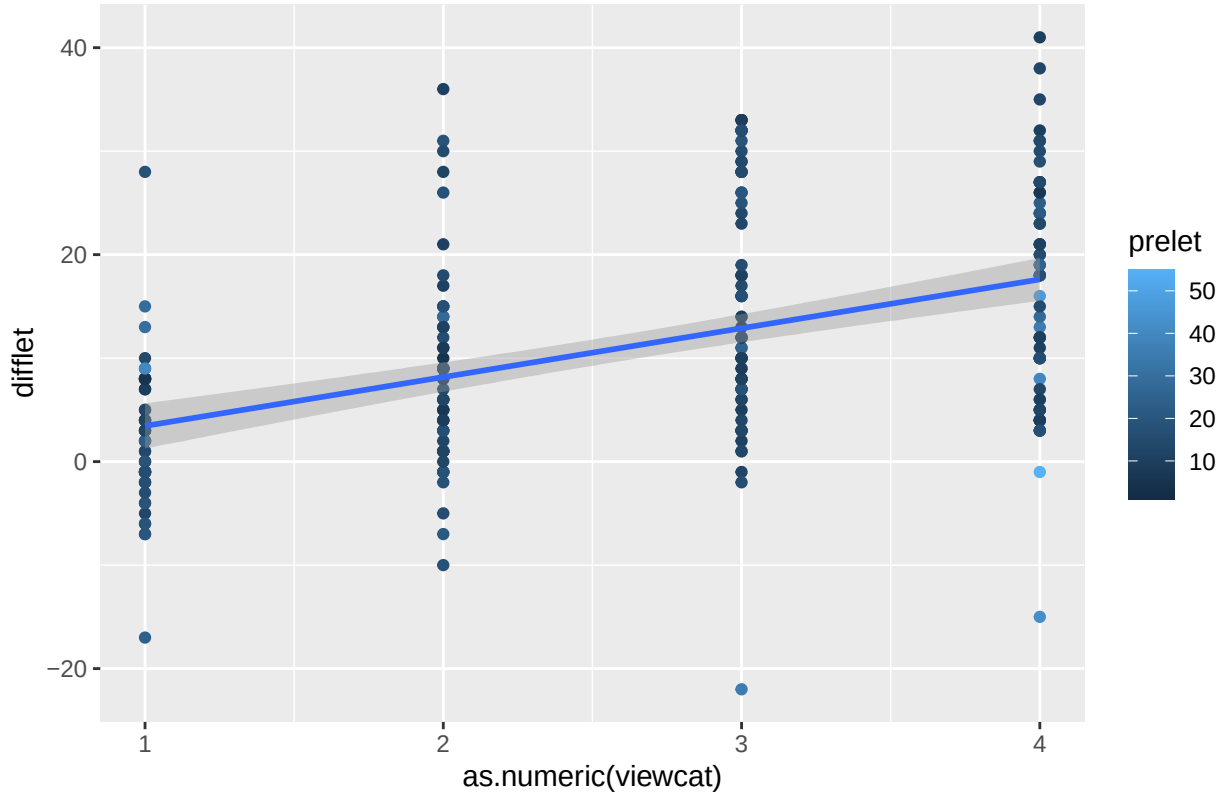

```
qplot(x = as.numeric(viewcat), y = diffnumb, data = sesame, color = age) +
  geom_smooth(method = "lm")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



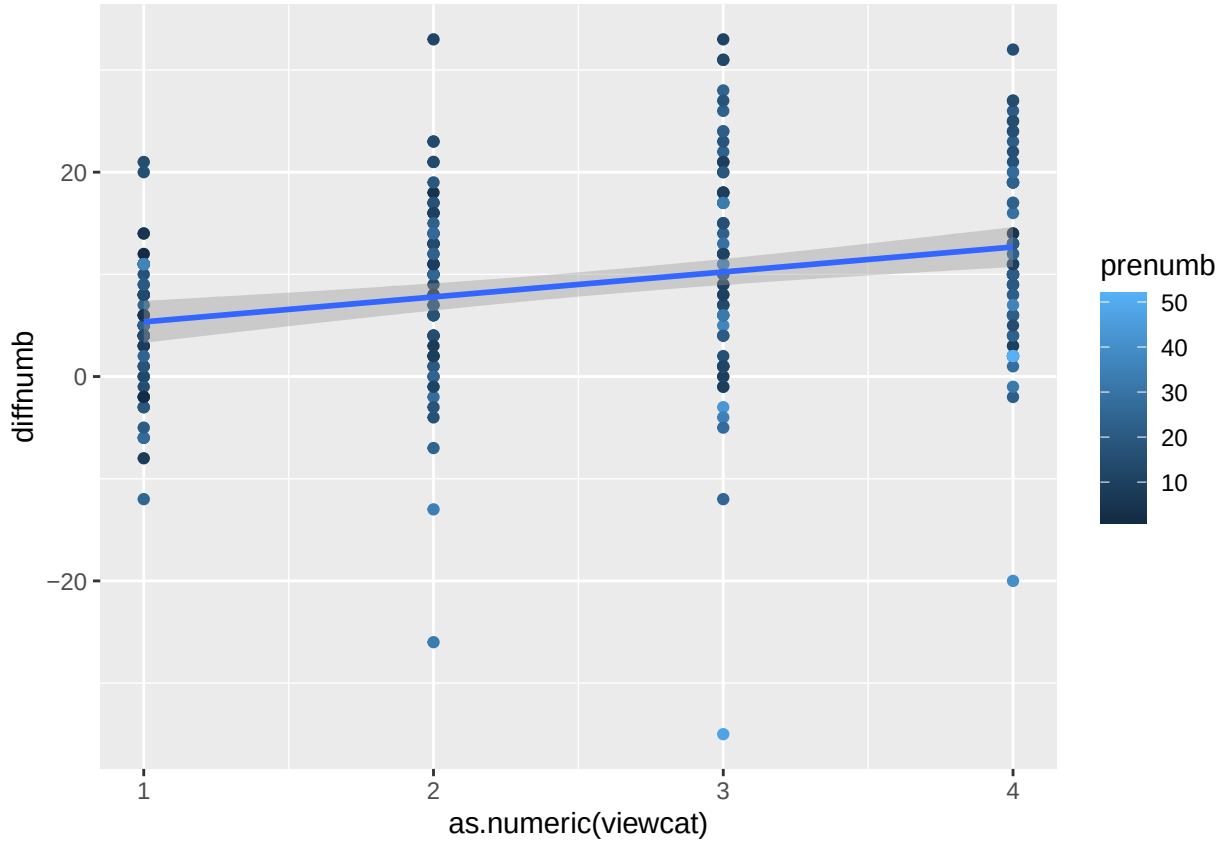

```
qplot(x = as.numeric(viewcat), y = difflet, data = sesame, color = prelet) +
  geom_smooth(method = "lm") + labs(title = "")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



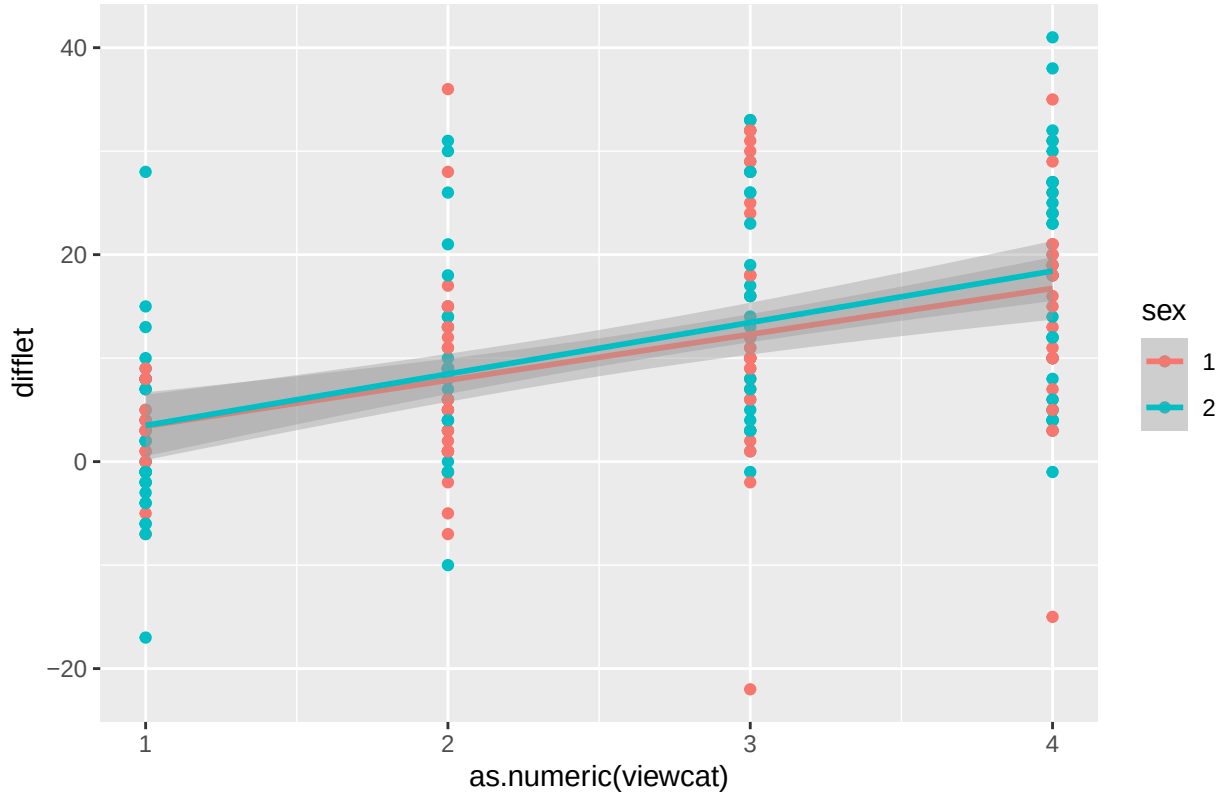

```
qplot(x = as.numeric(viewcat), y = diffnumb, data = sesame, color = prenumb) +
  geom_smooth(method = "lm")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



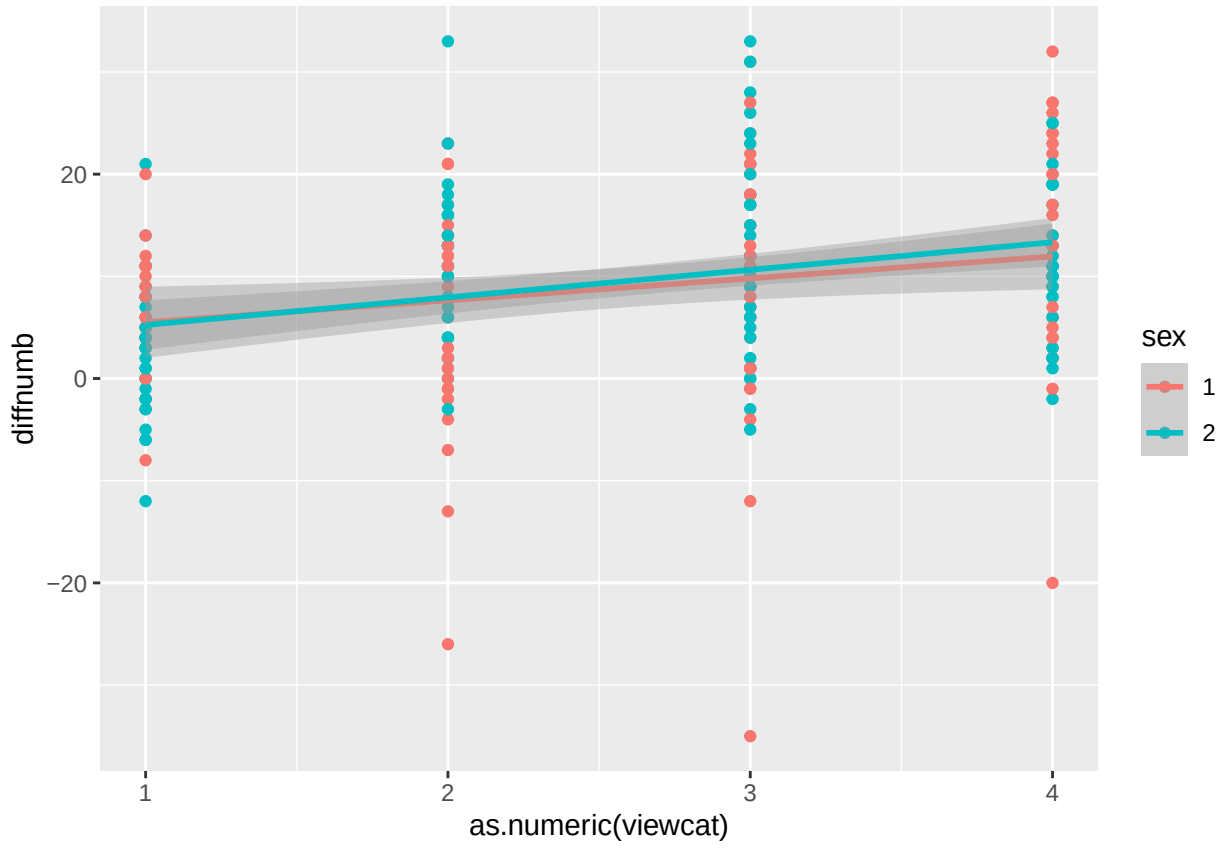

```
qplot(x = as.numeric(viewcat), y = difflet, data = sesame, color = sex) +
  geom_smooth(method = "lm") + labs(title = "")
```

```
## `geom_smooth()` using formula 'y ~ x'
```




```
qplot(x = as.numeric(viewcat), y = diffnumb, data = sesame, color = sex) +
  geom_smooth(method = "lm")
```

```
## `geom_smooth()` using formula 'y ~ x'
```




```
#related summary stats for all categories
sesame %>%
  group_by(site) %>%
  summarise(mean = mean(diffbody))
```

```
## # A tibble: 5 x 2
##   site            mean
##   <fct>          <dbl>
## 1 Disadv City     2.92
## 2 Adv Sub         2.82
## 3 Adv Rural       4.56
## 4 Disadv Rural    4.72
## 5 Disadv Spanish  5.61
```

```
sesame %>%
  group_by(site) %>%
  summarise(mean = mean(difflet))
```

```
## # A tibble: 5 x 2
##   site            mean
##   <fct>          <dbl>
## 1 Disadv City    10.3
## 2 Adv Sub        19.6
## 3 Adv Rural       6.70
## 4 Disadv Rural    6.86
## 5 Disadv Spanish  9.67
```

```
sesame %>%
  group_by(site) %>%
  summarise(mean = mean(diffform))
```

```
## # A tibble: 5 x 2
##   site            mean
##   <fct>          <dbl>
## 1 Disadv City     3.27
## 2 Adv Sub         4.31
## 3 Adv Rural       4.16
## 4 Disadv Rural    2.98
## 5 Disadv Spanish  4.89
```

```
sesame %>%
  group_by(site) %>%
  summarise(mean = mean(diffnumb))
```

```
## # A tibble: 5 x 2
##   site            mean
##   <fct>          <dbl>
## 1 Disadv City     7.85
## 2 Adv Sub        12.5
## 3 Adv Rural       8.88
## 4 Disadv Rural    6.72
## 5 Disadv Spanish 10.1
```

```
sesame %>%
  group_by(site) %>%
  summarise(mean = mean(diffrelat))
```

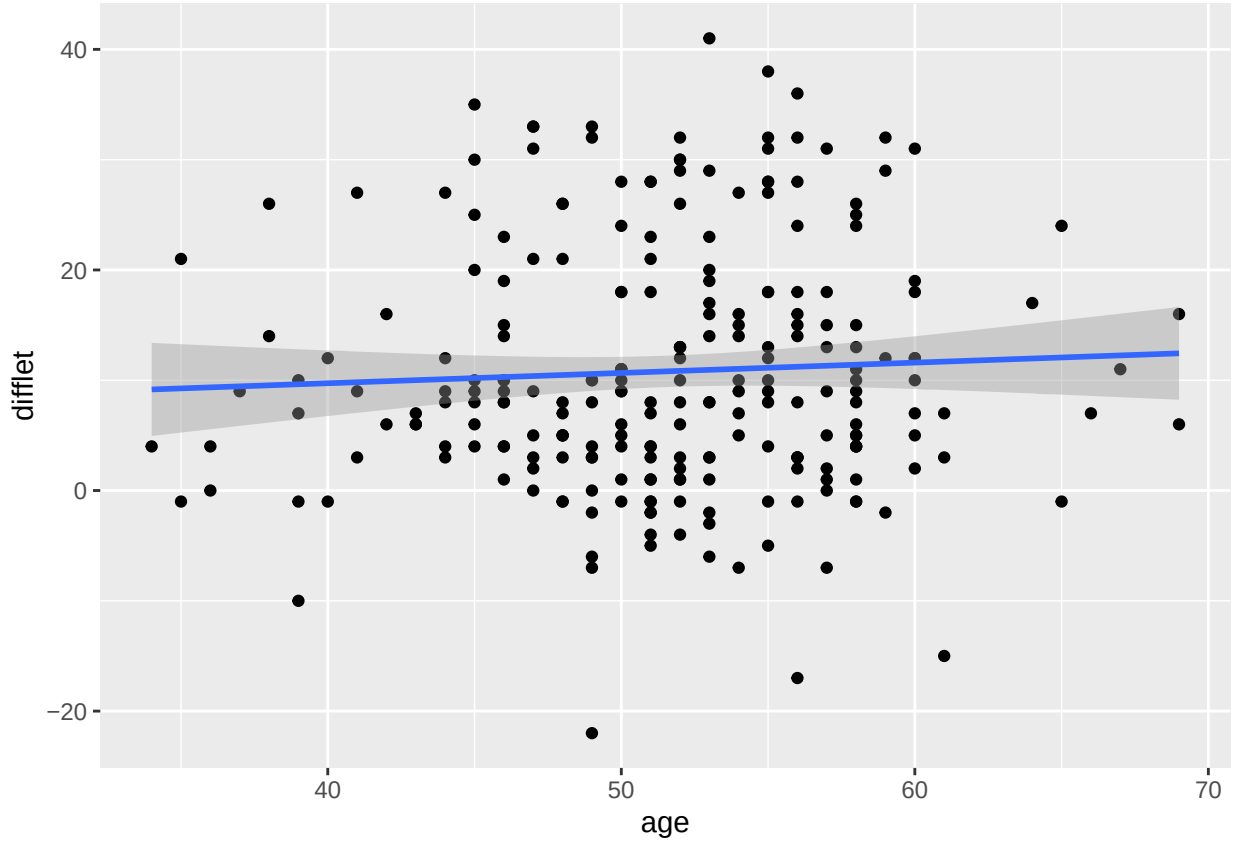
```
## # A tibble: 5 x 2
##   site            mean
##   <fct>          <dbl>
## 1 Disadv City    1.15
## 2 Adv Sub        1.44
## 3 Adv Rural      2.44
## 4 Disadv Rural   2.42
## 5 Disadv Spanish 0.556
```

```
sesame %>%
  group_by(site) %>%
  summarise(mean = mean(diffclasf))
```

```
## # A tibble: 5 x 2
##   site            mean
##   <fct>          <dbl>
## 1 Disadv City     3.22
## 2 Adv Sub         4.53
## 3 Adv Rural       3.39
## 4 Disadv Rural    2.44
## 5 Disadv Spanish  4.28
```

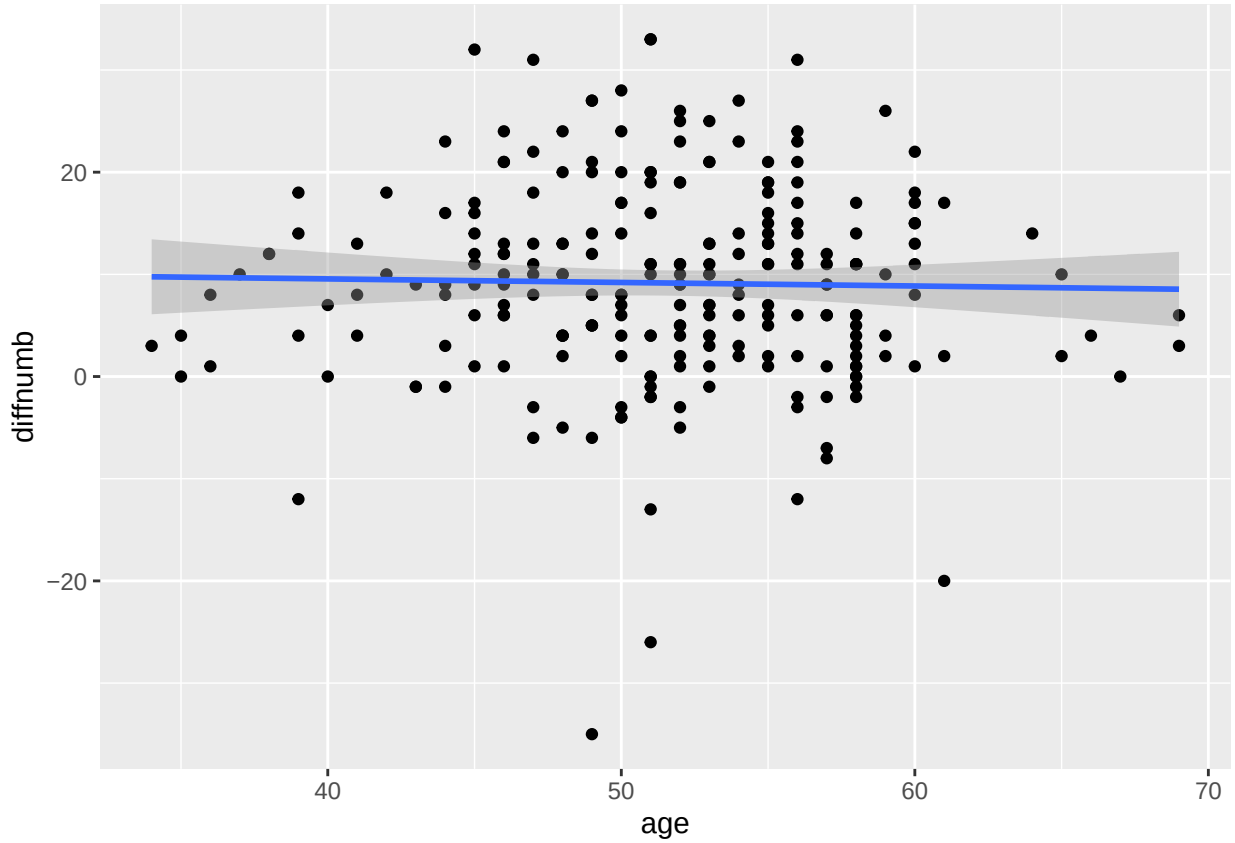
```
#age and difflet, diffnumb, since age was significant in earlier models. don't see much of a correlatio
ggplot(data = sesame, mapping = aes(x = age, y = difflet)) +
  geom_point() +
  geom_smooth(method = "lm")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



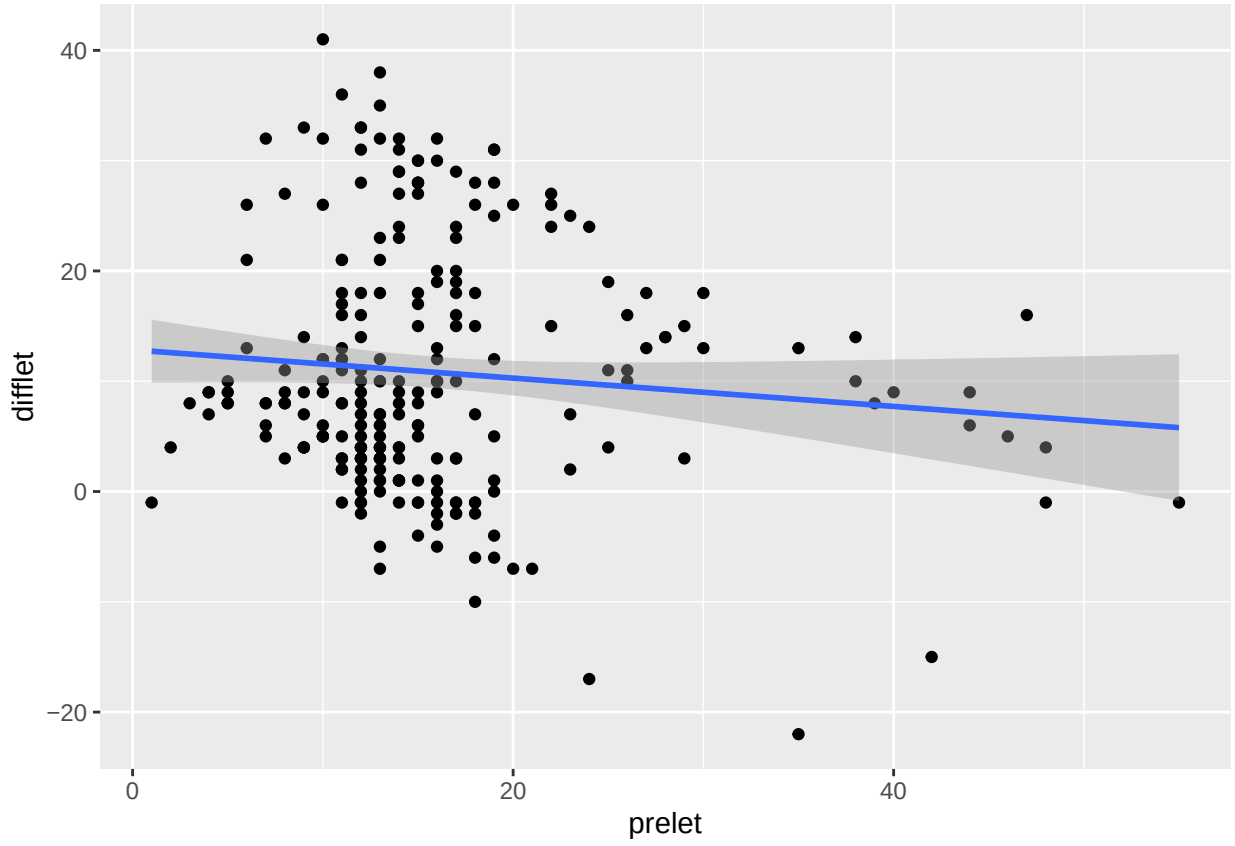

```
ggplot(data = sesame, mapping = aes(x = age, y = diffnumb)) +
  geom_point() +
  geom_smooth(method = "lm")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



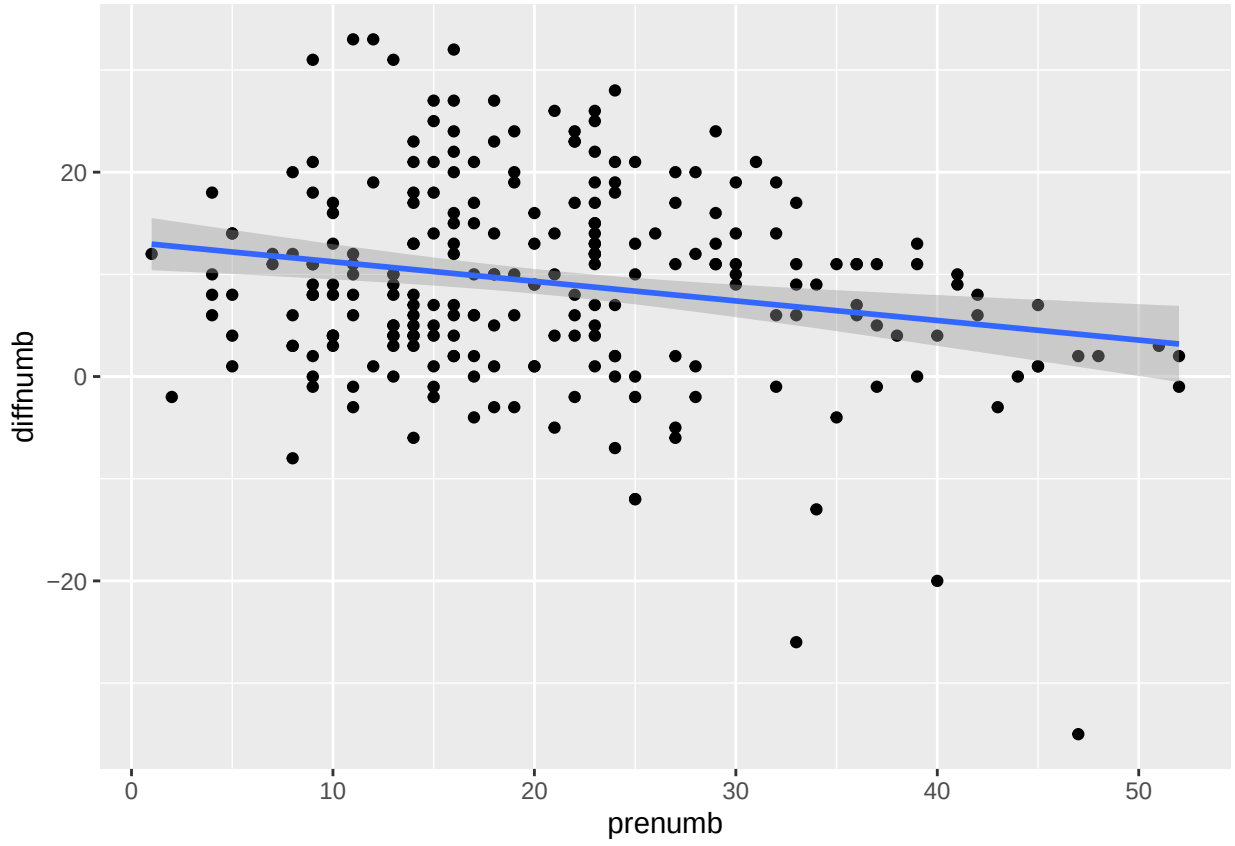

```
#prelet, prenumb and difflet, diffnumb, since age these were significant in earlier models. seems like
ggplot(data = sesame, mapping = aes(x = prelet, y = difflet)) +
  geom_point() +
  geom_smooth(method = "lm")
```

```
## `geom_smooth()` using formula 'y ~ x'
```

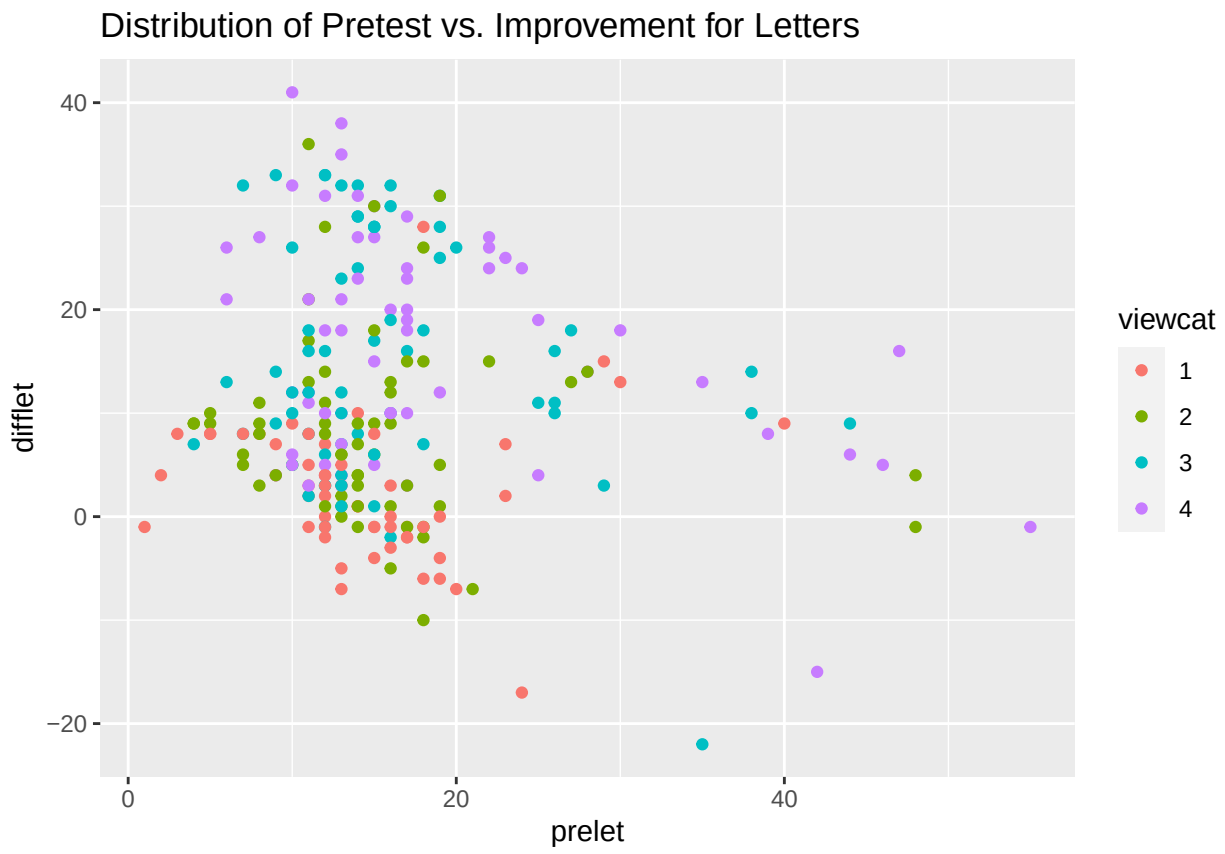



```
ggplot(data = sesame, mapping = aes(x = prenumb, y = diffnumb)) +
  geom_point() +
  geom_smooth(method = "lm")
```

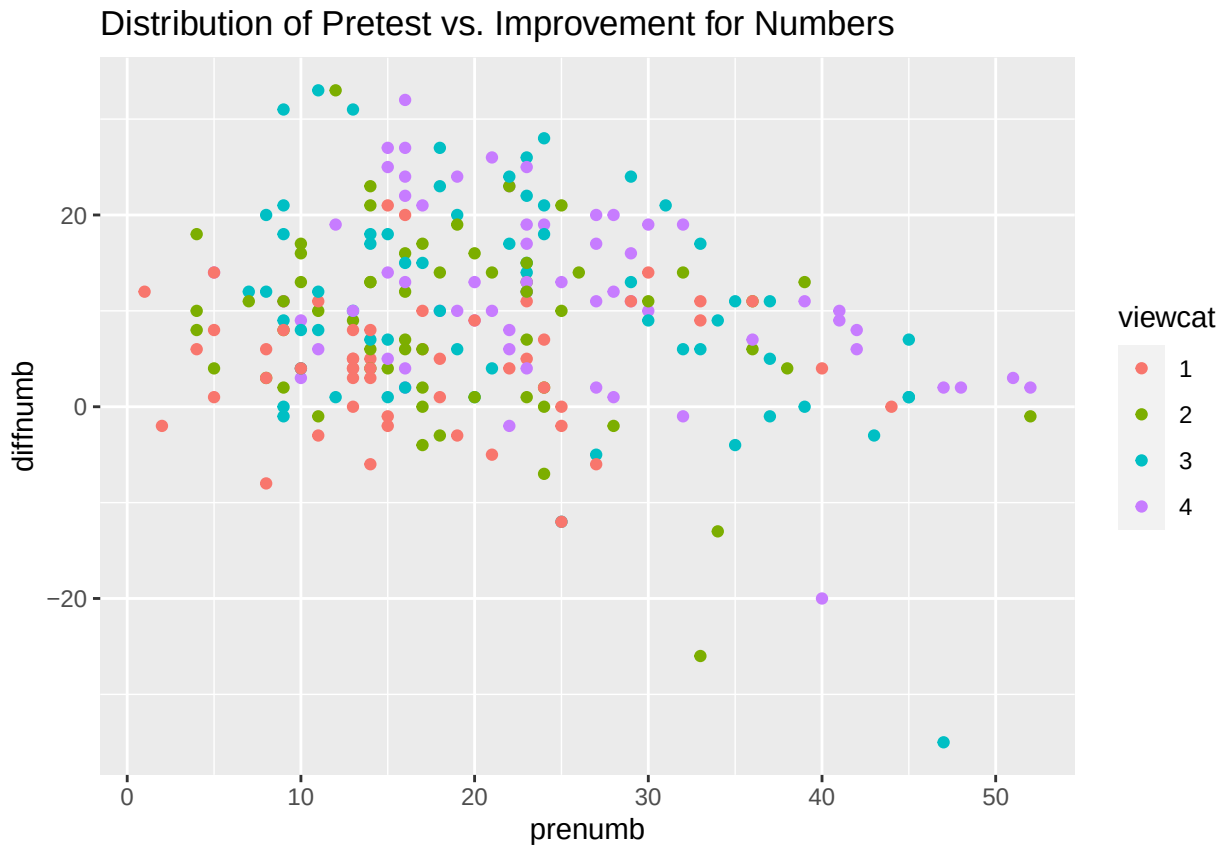
```
## `geom_smooth()` using formula 'y ~ x'
```




```
#these give an idea of how groups compared on their intial test scores and how much they improved

ggplot(data = sesame, mapping = aes(x = prelet, y = difflet, color = viewcat)) +
  geom_point() + labs(title = "Distribution of Pretest vs. Improvement for Letters")
```




```
ggplot(data = sesame, mapping = aes(x = prenumb, y = diffnumb, color = viewcat)) +
  geom_point() + labs(title = "Distribution of Pretest vs. Improvement for Numbers")
```




```
# Here I was trying to see whether or not any interaction terms are significant. First I tried to creat

lm_let_interact <- lm(difflet ~ viewcat + site + viewcat*site, data = sesame)
lm_numb_interact <- lm(diffnumb ~ viewcat + site + viewcat*site, data = sesame)
lm_let_interact_full <- lm(difflet ~ viewcat + site + viewcat*site + age + prelet + viewcat*age + viewca
lm_numb_interact_full <- lm(diffnumb ~ viewcat + site + viewcat*site + age + prenumb + viewcat*age + vie

summary(lm_let_interact)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + site + viewcat * site, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -38.200  -5.235  -0.183   5.609  22.857
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  2.33333    3.05517   0.764  0.44584
## viewcat2                     3.72549    3.77831   0.986  0.32521
## viewcat3                    13.86667    3.67891   3.769  0.00021 ***
## viewcat4                     9.80952    3.91593   2.505  0.01297 *
## siteAdv Sub                  8.91667    5.50778   1.619  0.10690
## siteAdv Rural               -3.33333    4.04161  -0.825  0.41040
## siteDisadv Rural             0.05797    3.60368   0.016  0.98718
```

```
## siteDisadv Spanish           1.83333    4.83065   0.380  0.70467
## viewcat2:siteAdv Sub         0.12451    6.60893   0.019  0.98499
## viewcat3:siteAdv Sub        -5.05784    6.28312  -0.805  0.42169
## viewcat4:siteAdv Sub         1.44048    6.31161   0.228  0.81968
## viewcat2:siteAdv Rural       1.50980    5.12032   0.295  0.76838
## viewcat3:siteAdv Rural      -1.51667    4.97345  -0.305  0.76069
## viewcat4:siteAdv Rural       0.65714    5.28540   0.124  0.90117
## viewcat2:siteDisadv Rural    5.38321    5.13115   1.049  0.29527
## viewcat3:siteDisadv Rural   -8.09130    5.58462  -1.449  0.14880
## viewcat4:siteDisadv Rural    6.79917    6.32365   1.075  0.28346
## viewcat2:siteDisadv Spanish  2.10784    6.50214   0.324  0.74611
## viewcat3:siteDisadv Spanish  0.96667   10.56134   0.092  0.92716
## viewcat4:siteDisadv Spanish  0.02381    6.79242   0.004  0.99721
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.166 on 220 degrees of freedom
## Multiple R-squared:   0.38,  Adjusted R-squared:  0.3265
## F-statistic: 7.097 on 19 and 220 DF,  p-value: 1.194e-14
```

```
summary(lm_numb_interact)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + site + viewcat * site, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -45.600  -4.780   0.000   5.965  23.286
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   4.0000     3.1335   1.277   0.2031
## viewcat2                      1.9412     3.8752   0.501   0.6169
## viewcat3                      6.6000     3.7732   1.749   0.0817 .
## viewcat4                      4.7143     4.0163   1.174   0.2418
## siteAdv Sub                   2.5000     5.6490   0.443   0.6585
## siteAdv Rural                -1.8333     4.1452  -0.442   0.6587
## siteDisadv Rural              0.8261     3.6961   0.224   0.8234
## siteDisadv Spanish            4.1667     4.9545   0.841   0.4013
## viewcat2:siteAdv Sub          5.5588     6.7784   0.820   0.4131
## viewcat3:siteAdv Sub         -0.3353     6.4442  -0.052   0.9586
## viewcat4:siteAdv Sub          1.4524     6.4734   0.224   0.8227
## viewcat2:siteAdv Rural        2.6569     5.2516   0.506   0.6134
## viewcat3:siteAdv Rural        1.2833     5.1010   0.252   0.8016
## viewcat4:siteAdv Rural        8.1857     5.4209   1.510   0.1325
## viewcat2:siteDisadv Rural     1.4327     5.2627   0.272   0.7857
## viewcat3:siteDisadv Rural    -2.9261     5.7278  -0.511   0.6100
## viewcat4:siteDisadv Rural     1.7096     6.4858   0.264   0.7923
## viewcat2:siteDisadv Spanish   1.3922     6.6688   0.209   0.8348
## viewcat3:siteDisadv Spanish   2.2333    10.8321   0.206   0.8368
## viewcat4:siteDisadv Spanish  -3.4810     6.9666  -0.500   0.6178
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 9.401 on 220 degrees of freedom
## Multiple R-squared:  0.1346, Adjusted R-squared:  0.05987
## F-statistic: 1.801 on 19 and 220 DF,  p-value: 0.02397
```

```
# Check for significant interaction with age
lm_let_age_interact <- lm(difflet ~ viewcat + age + viewcat*age, data = sesame)
lm_numb_age_interact <- lm(diffnumb ~ viewcat + age + viewcat*age, data = sesame)
summary(lm_let_age_interact)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + age + viewcat * age, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -36.807  -6.789  -0.780   5.572  25.446
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.64425   11.48801   0.143   0.8863
## viewcat2     -19.44626   15.91007  -1.222   0.2228
## viewcat3       9.47865   15.07198   0.629   0.5300
## viewcat4      29.05524   15.17602   1.915   0.0568 .
## age            0.01625    0.22149   0.073   0.9416
## viewcat2:age   0.49855    0.30886   1.614   0.1078
## viewcat3:age   0.05894    0.29035   0.203   0.8393
## viewcat4:age  -0.29603    0.29085  -1.018   0.3098
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.755 on 232 degrees of freedom
## Multiple R-squared:  0.2595, Adjusted R-squared:  0.2371
## F-statistic: 11.61 on 7 and 232 DF,  p-value: 1.214e-12
```

```
summary(lm_numb_age_interact)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + age + viewcat * age, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -45.581  -5.653   0.122   6.047  24.533
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   11.3288    11.0211   1.028    0.305
## viewcat2      -7.1187    15.2634  -0.466    0.641
## viewcat3      -6.9615    14.4593  -0.481    0.631
## viewcat4      15.1344    14.5592   1.040    0.300
## age           -0.1308     0.2125  -0.615    0.539
## viewcat2:age   0.2142     0.2963   0.723    0.470
```

```
## viewcat3:age   0.2576     0.2785   0.925    0.356
## viewcat4:age  -0.1464     0.2790  -0.525    0.600
##
## Residual standard error: 9.358 on 232 degrees of freedom
## Multiple R-squared:  0.09563,    Adjusted R-squared:  0.06835
## F-statistic: 3.505 on 7 and 232 DF,  p-value: 0.001356
```

```
lm_let_prelet_interact <- lm(difflet ~ viewcat + prelet + viewcat*prelet, data = sesame)
lm_numb_prenumb_interact <- lm(diffnumb ~ viewcat + prenumb + viewcat*prenumb, data = sesame)
summary(lm_let_prelet_interact)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + prelet + viewcat * prelet, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -32.142  -6.656  -0.535   5.788  27.102
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.74762    3.11898   0.881 0.379264
## viewcat2         7.69597    4.12142   1.867 0.063119 .
## viewcat3        16.29944    4.16306   3.915 0.000119 ***
## viewcat4        19.39873    3.97221   4.884 1.94e-06 ***
## prelet          -0.01845    0.19595  -0.094 0.925072
## viewcat2:prelet -0.12206    0.25308  -0.482 0.630041
## viewcat3:prelet -0.23598    0.25031  -0.943 0.346779
## viewcat4:prelet -0.31230    0.22795  -1.370 0.171991
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.686 on 232 degrees of freedom
## Multiple R-squared:  0.2699, Adjusted R-squared:  0.2479
## F-statistic: 12.25 on 7 and 232 DF,  p-value: 2.583e-13
```

```
summary(lm_numb_prenumb_interact)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + prenumb + viewcat * prenumb,
##     data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -35.789  -5.658  -0.151   6.048  22.700
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)       4.80702    2.49863   1.924   0.0556 .
## viewcat2          8.64125    3.54980   2.434   0.0157 *
## viewcat3         15.09773    3.52036   4.289 2.64e-05 ***
## viewcat4         15.21712    3.75686   4.050 6.97e-05 ***
```

```
## prenumb          -0.01257    0.12836  -0.098   0.9221
## viewcat2:prenumb -0.24980    0.17435  -1.433   0.1533
## viewcat3:prenumb -0.39414    0.16290  -2.419   0.0163 *
## viewcat4:prenumb -0.31366    0.16552  -1.895   0.0593 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.851 on 232 degrees of freedom
## Multiple R-squared:  0.191,  Adjusted R-squared:  0.1666
## F-statistic: 7.826 on 7 and 232 DF,  p-value: 1.656e-08
```

```
lm_let_sex_interact <- lm(difflet ~ viewcat + sex + viewcat*sex, data = sesame)
lm_numb_sex_interact <- lm(diffnumb ~ viewcat + sex + viewcat*sex, data = sesame)
summary(lm_let_sex_interact)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + sex + viewcat * sex, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -36.455  -6.067  -1.077   5.694  28.933
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.087      2.062   1.497    0.136
## viewcat2         3.980      2.740   1.452    0.148
## viewcat3        11.368      2.686   4.232 3.33e-05 ***
## viewcat4        12.292      2.761   4.452 1.32e-05 ***
## sex2            -1.055      2.721  -0.388    0.699
## viewcat2:sex2    3.621      3.731   0.971    0.333
## viewcat3:sex2    2.181      3.677   0.593    0.554
## viewcat4:sex2    2.403      3.707   0.648    0.517
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.888 on 232 degrees of freedom
## Multiple R-squared:  0.2391, Adjusted R-squared:  0.2161
## F-statistic: 10.41 on 7 and 232 DF,  p-value: 2.328e-11
```

```
summary(lm_numb_sex_interact)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + sex + viewcat * sex, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -44.576  -5.596  -0.323   5.601  22.200
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     6.9565     1.9318   3.601 0.000388 ***
```

```
## viewcat2       -0.8565     2.5677  -0.334 0.739004
## viewcat3        2.6192     2.5166   1.041 0.299054
## viewcat4        5.6987     2.5869   2.203 0.028585 *
## sex2           -4.1178     2.5497  -1.615 0.107665
## viewcat2:sex2   8.8178     3.4962   2.522 0.012336 *
## viewcat3:sex2   6.8646     3.4454   1.992 0.047500 *
## viewcat4:sex2   2.8869     3.4730   0.831 0.406699
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.265 on 232 degrees of freedom
## Multiple R-squared:  0.1136, Adjusted R-squared:  0.08682
## F-statistic: 4.246 on 7 and 232 DF,  p-value: 0.000197
```

Model Working - Sites:

```
site1 <- sesame %>%
  filter(site == "Disadv City")

lm_let_site1 <- lm(difflet ~ viewcat + age + prelet, data = site1)
lm_numb_site1 <- lm(diffnumb ~ viewcat + age + prenumb, data = site1)
summary(lm_let_site1)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + age + prelet, data = site1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -28.7869  -5.9767  -0.3158   7.5079  20.2906
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -9.8730     8.6555  -1.141 0.259046
## viewcat2      6.2168     4.2814   1.452 0.152275
## viewcat3     16.5824     4.1826   3.965 0.000218 ***
## viewcat4     14.8584     4.6101   3.223 0.002153 **
## age           0.3618     0.1712   2.113 0.039262 *
## prelet       -0.5043     0.1408  -3.581 0.000734 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.25 on 54 degrees of freedom
## Multiple R-squared:  0.3444, Adjusted R-squared:  0.2836
## F-statistic: 5.672 on 5 and 54 DF,  p-value: 0.0002831
```

```
summary(lm_numb_site1)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + age + prenumb, data = site1)
##
```

```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -29.0001  -5.7258   0.3417   5.9551  19.7258
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -12.7543     8.9238  -1.429  0.15869
## viewcat2      5.1136     4.2733   1.197  0.23667
## viewcat3     11.6874     4.2348   2.760  0.00788 **
## viewcat4     11.2735     4.5647   2.470  0.01671 *
## age           0.5450     0.1839   2.964  0.00451 **
## prenumb      -0.6732     0.1306  -5.155 3.69e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.25 on 54 degrees of freedom
## Multiple R-squared:  0.3571, Adjusted R-squared:  0.2976
## F-statistic:     6 on 5 and 54 DF,  p-value: 0.0001748
```

```
site2 <- sesame %>%
  filter(site == "Adv Sub")

lm_let_site2 <- lm(difflet ~ viewcat + age + prelet, data = site2)
lm_numb_site2 <- lm(diffnumb ~ viewcat + age + prenumb, data = site2)
summary(lm_let_site2)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + age + prelet, data = site2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.2258  -4.4533  -0.9108   5.8521  17.4240
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -5.3742    16.8365  -0.319  0.75093
## viewcat2      5.5870     5.4024   1.034  0.30613
## viewcat3     12.4952     5.1527   2.425  0.01904 *
## viewcat4     14.2799     4.9777   2.869  0.00606 **
## age           0.4548     0.3095   1.469  0.14814
## prelet       -0.5288     0.1554  -3.403  0.00134 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.085 on 49 degrees of freedom
## Multiple R-squared:  0.3062, Adjusted R-squared:  0.2354
## F-statistic: 4.326 on 5 and 49 DF,  p-value: 0.002442
```

```
summary(lm_numb_site2)
```

```
##
## Call:
```

```
## lm(formula = diffnumb ~ viewcat + age + prenumb, data = site2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -16.0032  -3.6010  -0.1088   6.0638  13.7954
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.4829    15.1373   0.098  0.92236
## viewcat2      9.6995     4.8527   1.999  0.05119 .
## viewcat3      9.9029     4.7108   2.102  0.04070 *
## viewcat4      8.7640     4.4861   1.954  0.05647 .
## age           0.2269     0.2902   0.782  0.43803
## prenumb      -0.3553     0.1258  -2.824  0.00684 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.096 on 49 degrees of freedom
## Multiple R-squared:  0.1773, Adjusted R-squared:  0.0933
## F-statistic: 2.111 on 5 and 49 DF,  p-value: 0.07975
```

```
site3 <- sesame %>%
  filter(site == "Adv Rural")

lm_let_site3 <- lm(difflet ~ viewcat + age + prelet, data = site3)
lm_numb_site3 <- lm(diffnumb ~ viewcat + age + prenumb, data = site3)
summary(lm_let_site3)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + age + prelet, data = site3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -14.6379  -4.7124  -0.7541   4.1823  16.1924
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  6.76612    8.23972   0.821 0.414918
## viewcat2     5.35658    2.66531   2.010 0.049118 *
## viewcat3    13.14796    2.72910   4.818 1.08e-05 ***
## viewcat4    11.21109    2.86240   3.917 0.000239 ***
## age         -0.15009    0.16822  -0.892 0.375971
## prelet      -0.03014    0.21002  -0.144 0.886390
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.061 on 58 degrees of freedom
## Multiple R-squared:  0.3277, Adjusted R-squared:  0.2697
## F-statistic: 5.654 on 5 and 58 DF,  p-value: 0.0002595
```

```
summary(lm_numb_site3)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + age + prenumb, data = site3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.3511  -4.8791   0.3004   5.1427  20.3917
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  14.0735     8.7263   1.613 0.112223
## viewcat2      5.8707     2.8321   2.073 0.042635 *
## viewcat3      9.9257     2.8629   3.467 0.000998 ***
## viewcat4     15.9004     3.0545   5.206 2.66e-06 ***
## age          -0.1444     0.1821  -0.793 0.430866
## prenumb      -0.3659     0.1449  -2.526 0.014307 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.423 on 58 degrees of freedom
## Multiple R-squared:  0.3534, Adjusted R-squared:  0.2977
## F-statistic: 6.341 on 5 and 58 DF,  p-value: 9.267e-05
```

```
site4 <- sesame %>%
  filter(site == "Disadv Rural")

lm_let_site4 <- lm(difflet ~ viewcat + age + prelet, data = site4)
lm_numb_site4 <- lm(diffnumb ~ viewcat + age + prenumb, data = site4)
summary(lm_let_site4)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + age + prelet, data = site4)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.5327  -4.5441  -0.6393   3.3524  18.8723
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -33.27329   15.55204  -2.139 0.039060 *
## viewcat2      9.00398    2.90671   3.098 0.003712 **
## viewcat3      7.93997    3.61512   2.196 0.034413 *
## viewcat4     15.60407    4.11761   3.790 0.000539 ***
## age           0.70394    0.31092   2.264 0.029522 *
## prelet       -0.08054    0.22437  -0.359 0.721665
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.539 on 37 degrees of freedom
## Multiple R-squared:  0.4285, Adjusted R-squared:  0.3513
## F-statistic: 5.548 on 5 and 37 DF,  p-value: 0.000655
```

```
summary(lm_numb_site4)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + age + prenumb, data = site4)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -13.7355  -4.7945  -0.3455   4.6429  15.2194
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 10.25730   16.94198   0.605    0.549
## viewcat2     2.93896    2.96535   0.991    0.328
## viewcat3     3.26818    3.72163   0.878    0.386
## viewcat4     6.97850    4.23123   1.649    0.108
## age         -0.04229    0.34611  -0.122    0.903
## prenumb     -0.16877    0.15874  -1.063    0.295
##
## Residual standard error: 7.763 on 37 degrees of freedom
## Multiple R-squared:  0.121,  Adjusted R-squared:  0.002179
## F-statistic: 1.018 on 5 and 37 DF,  p-value: 0.4209
```

```
site5 <- sesame %>%
  filter(site == "Disadv Spanish")

lm_let_site5 <- lm(difflet ~ viewcat + age + prelet, data = site5)
lm_numb_site5 <- lm(diffnumb ~ viewcat + age + prenumb, data = site5)
summary(lm_let_site5)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + age + prelet, data = site5)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.8034 -6.9687 -0.2015  4.7214 15.6128
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -2.3599    23.6778  -0.100   0.9223
## viewcat2      5.6551     5.0828   1.113   0.2877
## viewcat3     13.3929     9.7227   1.377   0.1935
## viewcat4     11.9715     5.6032   2.137   0.0539 .
## age           0.1969     0.4688   0.420   0.6819
## prelet       -0.2405     0.2156  -1.116   0.2864
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.524 on 12 degrees of freedom
## Multiple R-squared:  0.3434, Adjusted R-squared:  0.06986
## F-statistic: 1.255 on 5 and 12 DF,  p-value: 0.3439
```

```
summary(lm_numb_site5)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + age + prenumb, data = site5)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.682  -5.022  -2.042   3.466  21.053
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.50383   30.99077   0.016    0.987
## viewcat2     3.81313    6.00059   0.635    0.537
## viewcat3     8.97897   11.31622   0.793    0.443
## viewcat4     2.55655    7.87541   0.325    0.751
## age          0.16778    0.64050   0.262    0.798
## prenumb     -0.07726    0.32429  -0.238    0.816
##
## Residual standard error: 9.867 on 12 degrees of freedom
## Multiple R-squared:  0.07267,    Adjusted R-squared:  -0.3137
## F-statistic: 0.1881 on 5 and 12 DF,  p-value: 0.9615
```

```
sitemodel1 <- lm(difflet ~ site, data = sesame)
sitemodel2 <- lm(diffnumb ~ site, data = sesame)
summary(sitemodel1)
```

```
##
## Call:
## lm(formula = difflet ~ site, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -32.300  -6.370  -1.685   6.327  24.700
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         10.3000     1.2989   7.930 8.86e-14 ***
## siteAdv Sub          9.2818     1.8782   4.942 1.47e-06 ***
## siteAdv Rural       -3.5969     1.8080  -1.989   0.0478 *
## siteDisadv Rural    -3.4395     2.0103  -1.711   0.0884 .
## siteDisadv Spanish  -0.6333     2.7039  -0.234   0.8150
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.06 on 235 degrees of freedom
## Multiple R-squared:  0.202,  Adjusted R-squared:  0.1884
## F-statistic: 14.87 on 4 and 235 DF,  p-value: 7.573e-11
```

```
summary(sitemodel2)
```

```
##
```

```
## Call:
## lm(formula = diffnumb ~ site, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -42.850  -5.548   0.150   5.279  24.150
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)            7.850      1.234   6.361 1.04e-09 ***
## siteAdv Sub            4.641      1.785   2.601   0.0099 **
## siteAdv Rural          1.025      1.718   0.597   0.5513
## siteDisadv Rural      -1.129      1.910  -0.591   0.5550
## siteDisadv Spanish     2.261      2.569   0.880   0.3797
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.559 on 235 degrees of freedom
## Multiple R-squared:  0.04409,    Adjusted R-squared:  0.02782
## F-statistic:  2.71 on 4 and 235 DF,  p-value: 0.03091
```

Question 3 Work: Can we accurately predict how students' test scores might change based on their demographic characteristics and how much they watch sesame street?

My first attempt is through using regression trees with the target of predicting both difflet and diffnum based off of the demogrpahic characteristics and how much they actually watch the program.

```
# Check basic linear models for prediction accuracy
q3_let <- lm(difflet ~ viewcat + site + sex + age + setting + viewenc + prelet, data = sesame)
q3_numb <- lm(diffnumb ~ viewcat + site + sex + age + setting + viewenc + prenumb, data = sesame)
summary(q3_let)
```

```
##
## Call:
## lm(formula = difflet ~ viewcat + site + sex + age + setting +
##     viewenc + prelet, data = sesame)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -27.1393  -5.7767  -0.3871   5.3748  22.3810
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -4.4449     5.1291  -0.867 0.387079
## viewcat2             4.9189     1.8247   2.696 0.007549 **
## viewcat3            11.3036     1.8533   6.099 4.55e-09 ***
## viewcat4            11.7038     1.8763   6.238 2.15e-09 ***
## siteAdv Sub          7.3534     1.6488   4.460 1.29e-05 ***
## siteAdv Rural       -5.6164     1.6637  -3.376 0.000866 ***
## siteDisadv Rural    -0.9142     1.8507  -0.494 0.621781
## siteDisadv Spanish   1.1531     2.5079   0.460 0.646112
## sex2                 1.0320     1.1304   0.913 0.362268
## age                  0.2653     0.1002   2.648 0.008654 **
## setting2             0.5178     1.3151   0.394 0.694147
```

```
## viewenc2            -1.7690     1.3588  -1.302 0.194301
## prelet              -0.3700     0.0734  -5.041 9.45e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.644 on 227 degrees of freedom
## Multiple R-squared:  0.431,  Adjusted R-squared:  0.4009
## F-statistic: 14.33 on 12 and 227 DF,  p-value: < 2.2e-16
```

```
summary(q3_numb)
```

```
##
## Call:
## lm(formula = diffnumb ~ viewcat + site + sex + age + setting +
##     viewenc + prenumb, data = sesame)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -33.221  -5.345   0.101   5.787  21.250
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -1.6423838  5.2657240  -0.312  0.75540
## viewcat2            4.8780848  1.8293863   2.667  0.00822 **
## viewcat3            8.2927760  1.8686366   4.438 1.42e-05 ***
## viewcat4            9.2235975  1.8902507   4.880 2.00e-06 ***
## siteAdv Sub         5.0031352  1.6605259   3.013  0.00288 **
## siteAdv Rural      -0.8426091  1.6971497  -0.496  0.62003
## siteDisadv Rural    0.1257674  1.8528662   0.068  0.94594
## siteDisadv Spanish  4.1947749  2.5148988   1.668  0.09670 .
## sex2                0.6955432  1.1330796   0.614  0.53993
## age                 0.2132147  0.1074394   1.985  0.04840 *
## setting2            1.8588384  1.3146815   1.414  0.15876
## viewenc2           -0.0003386  1.3560458   0.000  0.99980
## prenumb            -0.4016197  0.0648698  -6.191 2.77e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.663 on 227 degrees of freedom
## Multiple R-squared:  0.2417, Adjusted R-squared:  0.2016
## F-statistic: 6.028 on 12 and 227 DF,  p-value: 3.929e-09
```

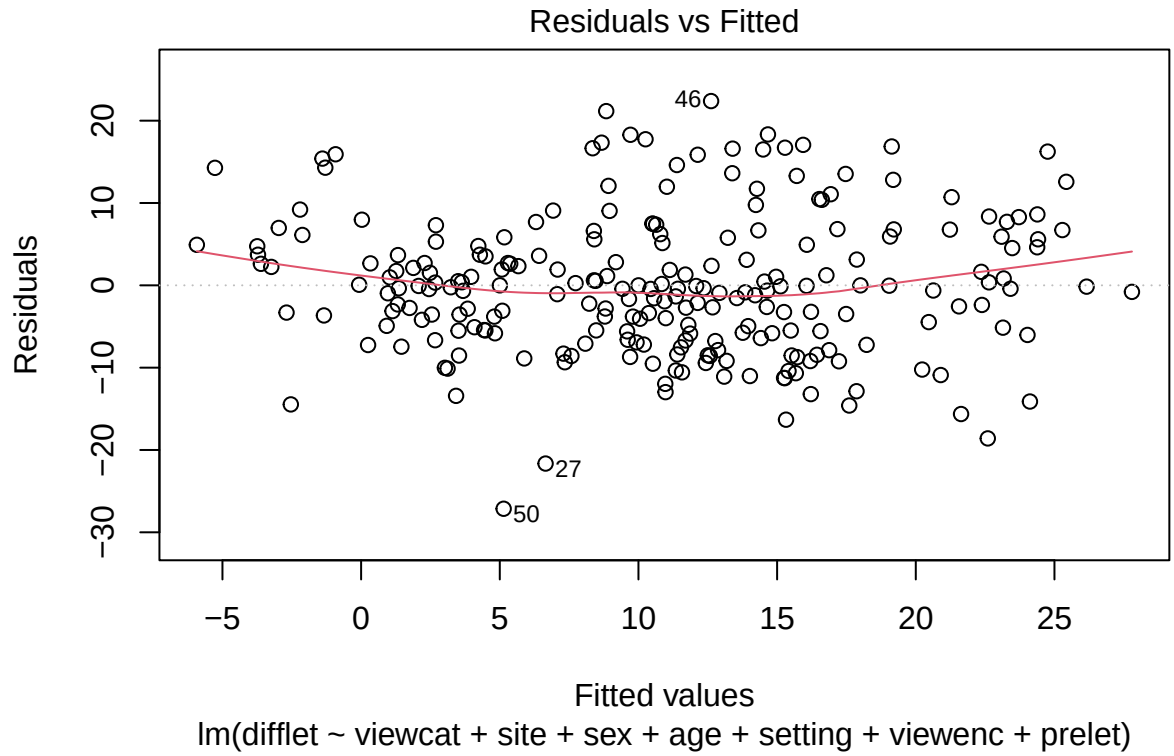
```
# Look at MSPE for linear models
pred_let <- predict(q3_let, newdata = sesame)
mean((sesame$difflet - pred_let)^2)
```

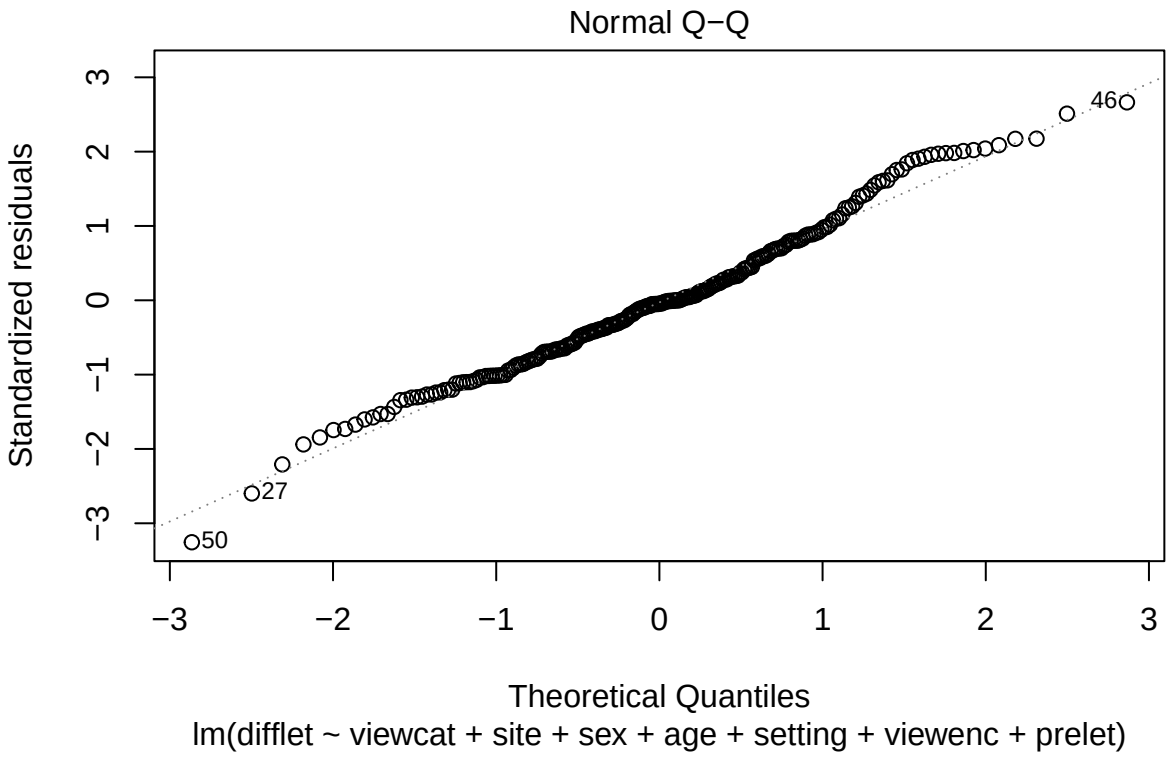
```
## [1] 70.6775
```

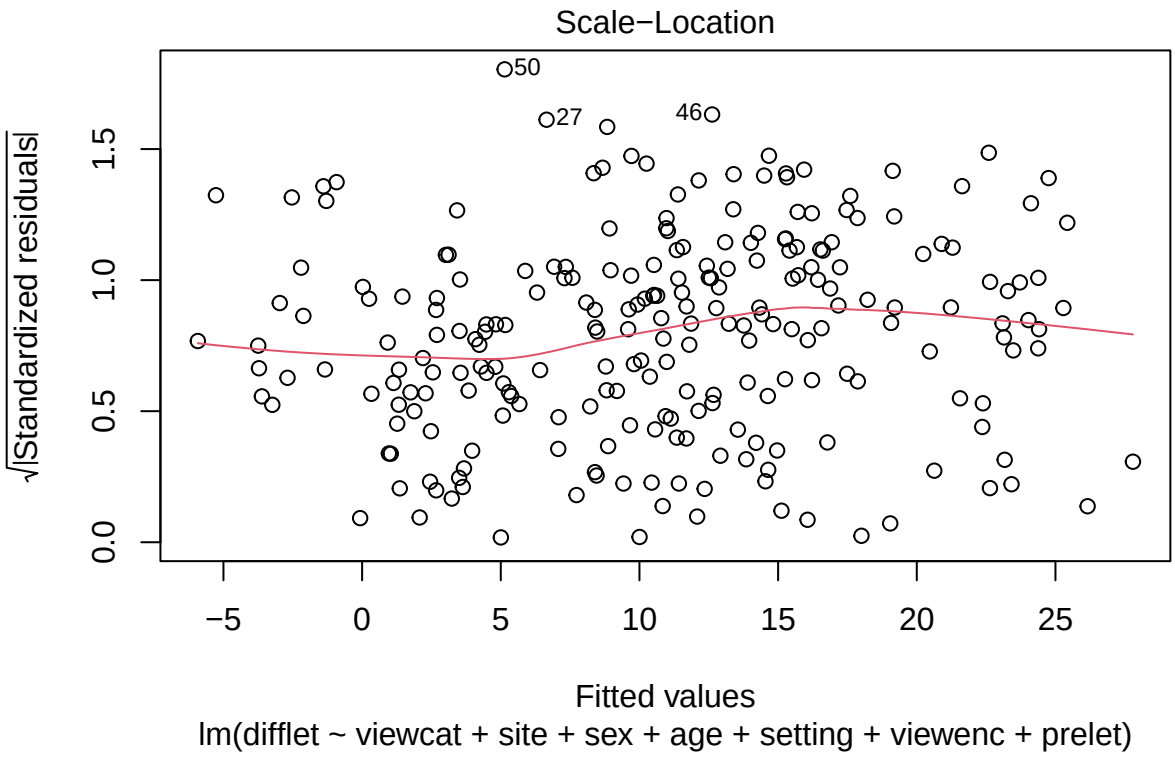
```
pred_numb <- predict(q3_numb, newdata = sesame)
mean((sesame$diffnumb - pred_numb)^2)
```

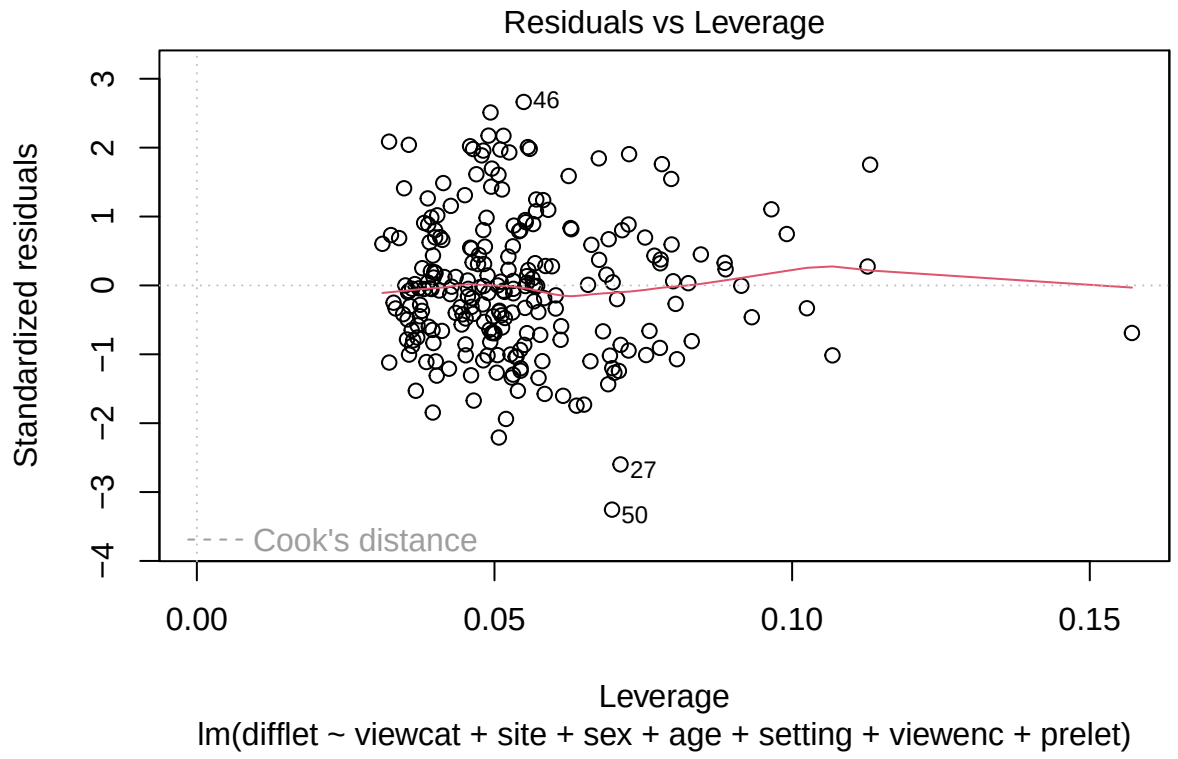
```
## [1] 70.98398
```

```r
# Check model conditions for linear
plot(q3_let)
```

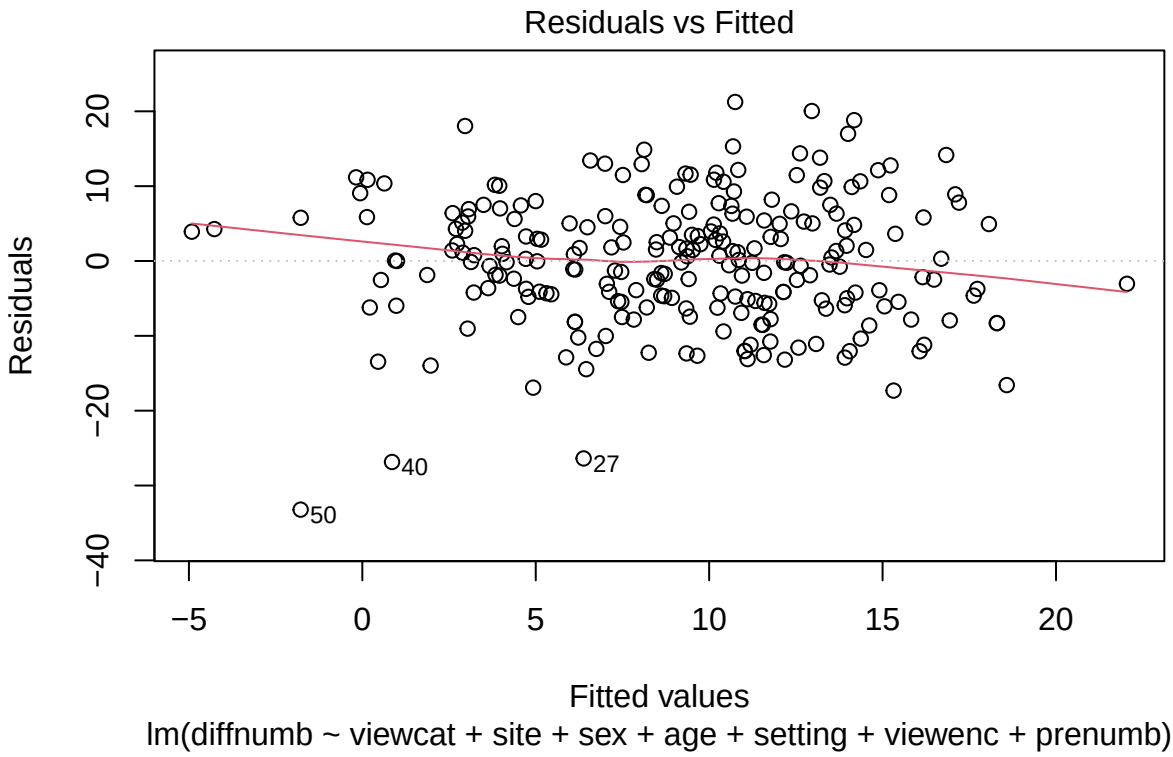


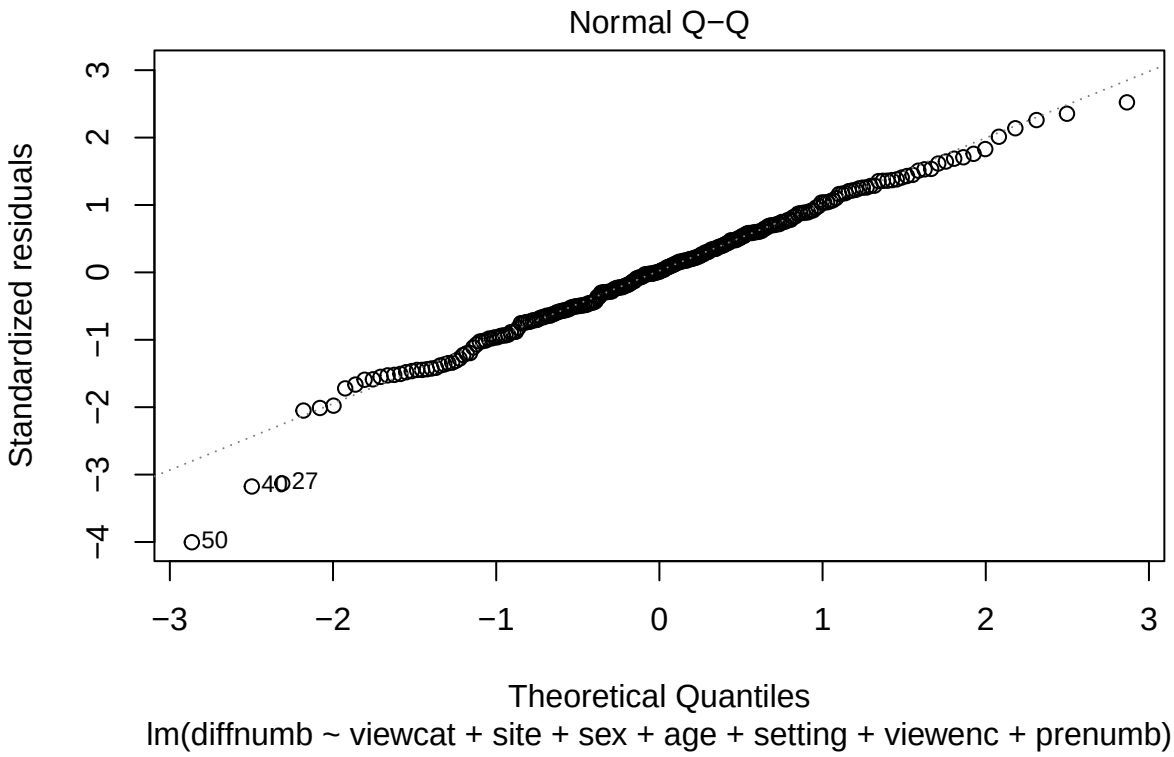

Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(difflet ~ viewcat + site + sex + age + setting + viewenc + prelet)
46
27
50

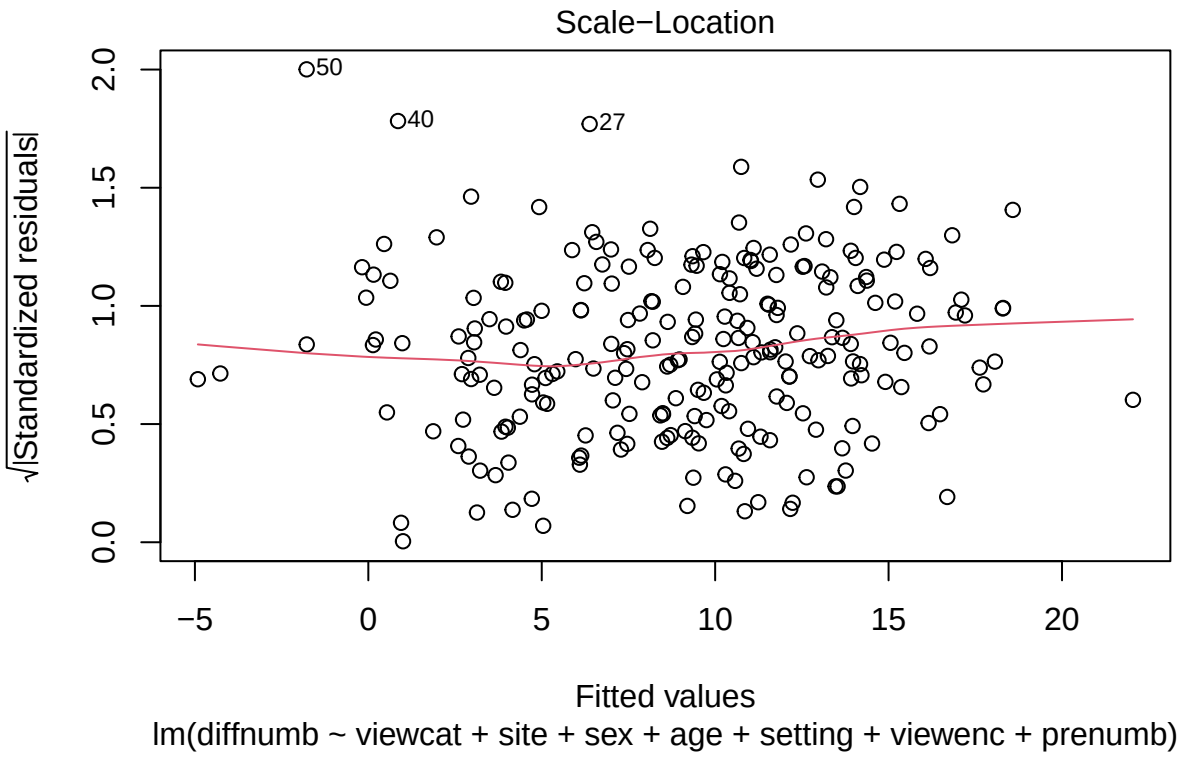

Scale−Location
50
27
46
√|Standardized residuals|
0.0
0.5
1.0
1.5
−5
0
5
10
15
20
25
Fitted values
lm(difflet ~ viewcat + site + sex + age + setting + viewenc + prelet)

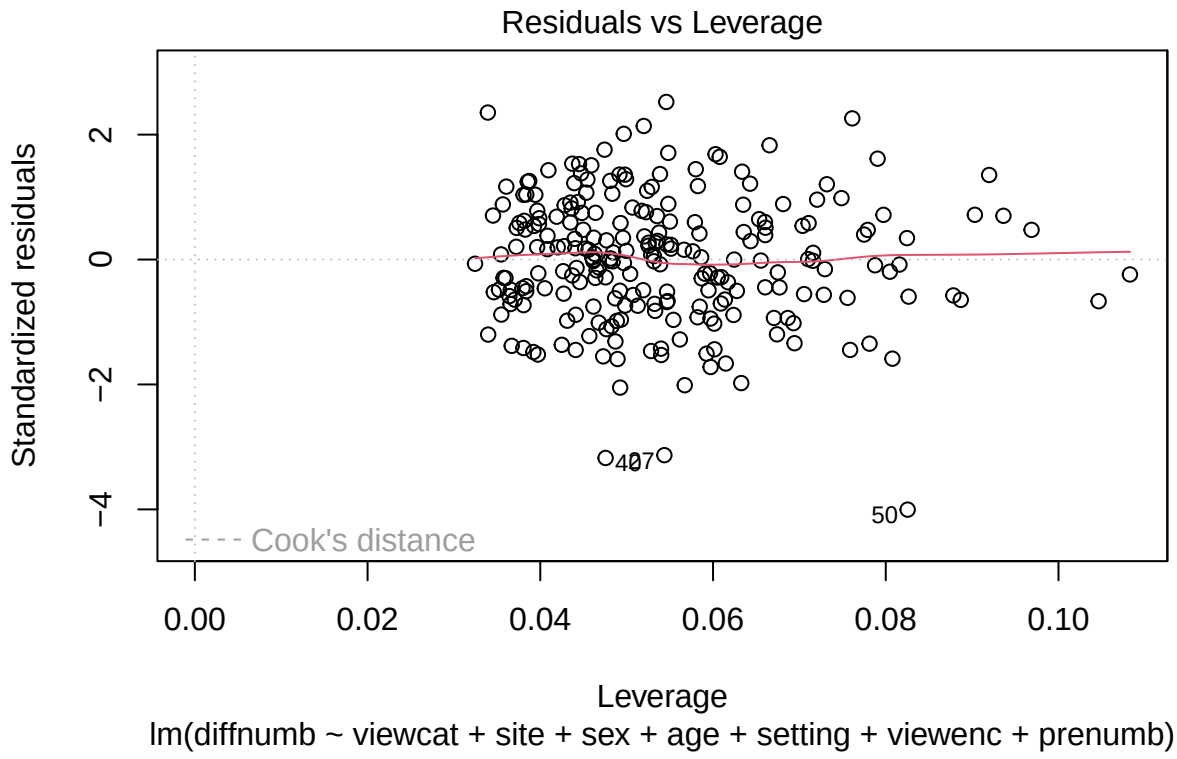

Residuals vs Leverage
Standardized residuals
3
2
1
0
−1
−2
−3
−4
46
27
50
Cook's distance
0.00
0.05
0.10
0.15
Leverage
lm(difflet ~ viewcat + site + sex + age + setting + viewenc + prelet)

```
plot(q3_numb)
```


Residuals vs Fitted
Residuals
20
10
0
−20
−40
−5
0
5
10
15
20
40
27
50
Fitted values
lm(diffnumb ~ viewcat + site + sex + age + setting + viewenc + prenumb)


Normal Q−Q
Standardized residuals
3
2
1
0
−1
−2
−3
−4
40
27
50
−3
−2
−1
0
1
2
3
Theoretical Quantiles
lm(diffnumb ~ viewcat + site + sex + age + setting + viewenc + prenumb)


Scale−Location
√|Standardized residuals|
0.0
0.5
1.0
1.5
2.0
50
40
27
−5
0
5
10
15
20
Fitted values
lm(diffnumb ~ viewcat + site + sex + age + setting + viewenc + prenumb)




```
library(tree)
library(MASS)
```

```
##
## Attaching package: 'MASS'
```

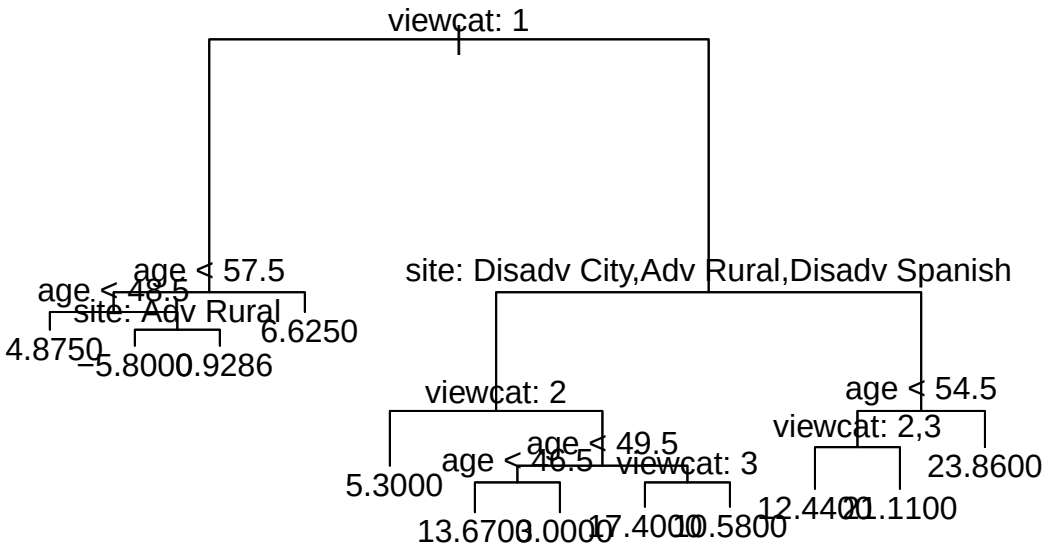
```
## The following object is masked from 'package:dplyr':
##
##     select
```

```
set.seed(4)
train <- sample(1:nrow(sesame), nrow(sesame)/2)
tree.letters <- tree(difflet ~ site + viewcat + age + sex, sesame, subset = train)
summary(tree.letters)
```

```
##
## Regression tree:
## tree(formula = difflet ~ site + viewcat + age + sex, data = sesame,
##     subset = train)
## Variables actually used in tree construction:
## [1] "viewcat" "age"     "site"
## Number of terminal nodes:  12
## Residual mean deviance:  68.27 = 7373 / 108
## Distribution of residuals:
```

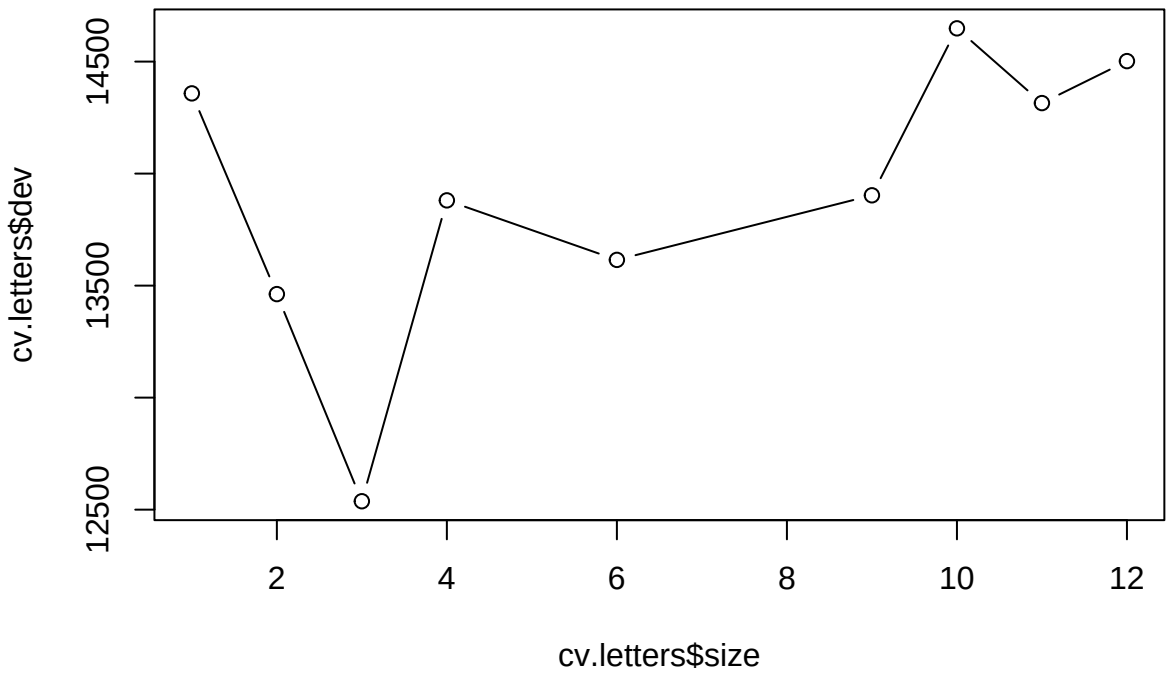
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -25.000  -4.334  -1.020   0.000   4.917  19.890
```

```
plot(tree.letters)
text(tree.letters, pretty = 0)
```



Attempt at pruning...

```
cv.letters <- cv.tree(tree.letters)
plot(cv.letters$size, cv.letters$dev, type = "b")
```

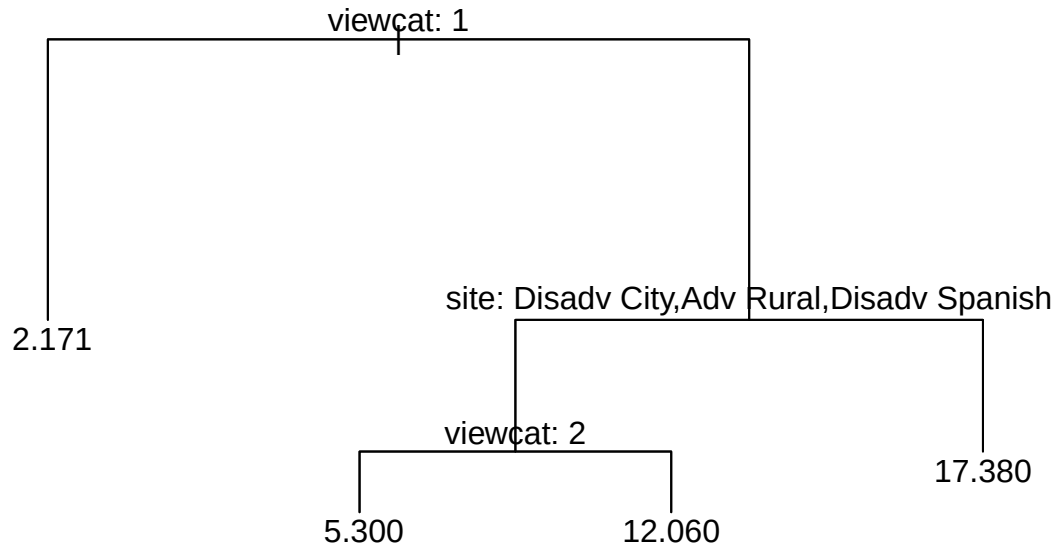


Based off of this, the CV shows that the best tree is one with 4 nodes. I made that tree below...

```
prune.letters <- prune.tree(tree.letters, best = 4)
summary(prune.letters)
```

```
##
## Regression tree:
## snip.tree(tree = tree.letters, nodes = c(2L, 13L, 7L))
## Variables actually used in tree construction:
## [1] "viewcat" "site"
## Number of terminal nodes:  4
## Residual mean deviance:  81.69 = 9477 / 116
## Distribution of residuals:
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -34.060  -5.546  -1.061   0.000   5.732  23.620
```

```
plot(prune.letters)
title(main = "Prediction Tree of Letter Test Score Improvement")
text(prune.letters, pretty = 0)
```

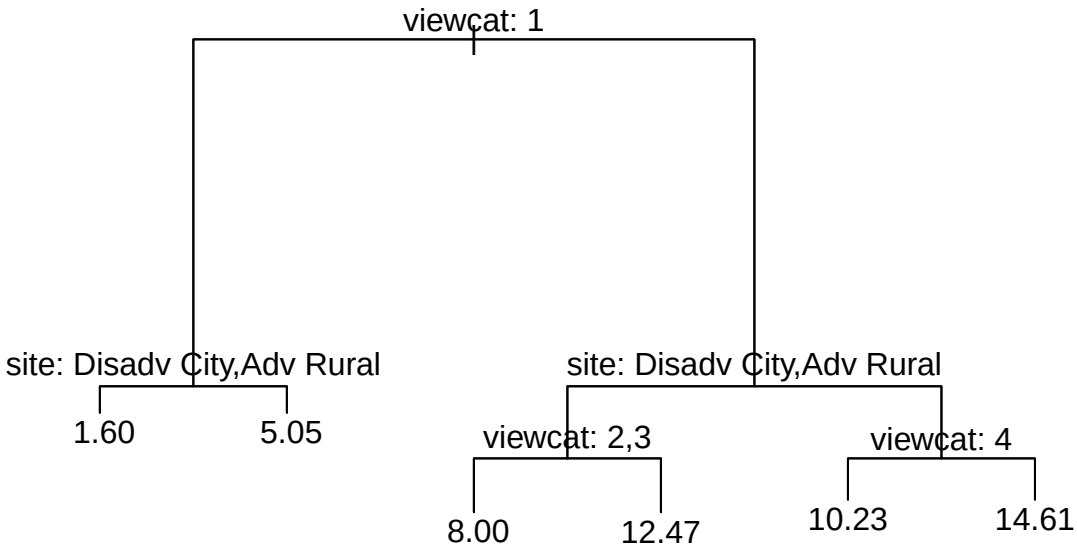



```
yhat <- predict(prune.letters, newdata = sesame[-train,])
letter.test <- sesame[-train, "difflet"]
#plot(yhat, letter.test)
#abline(0,1)
```

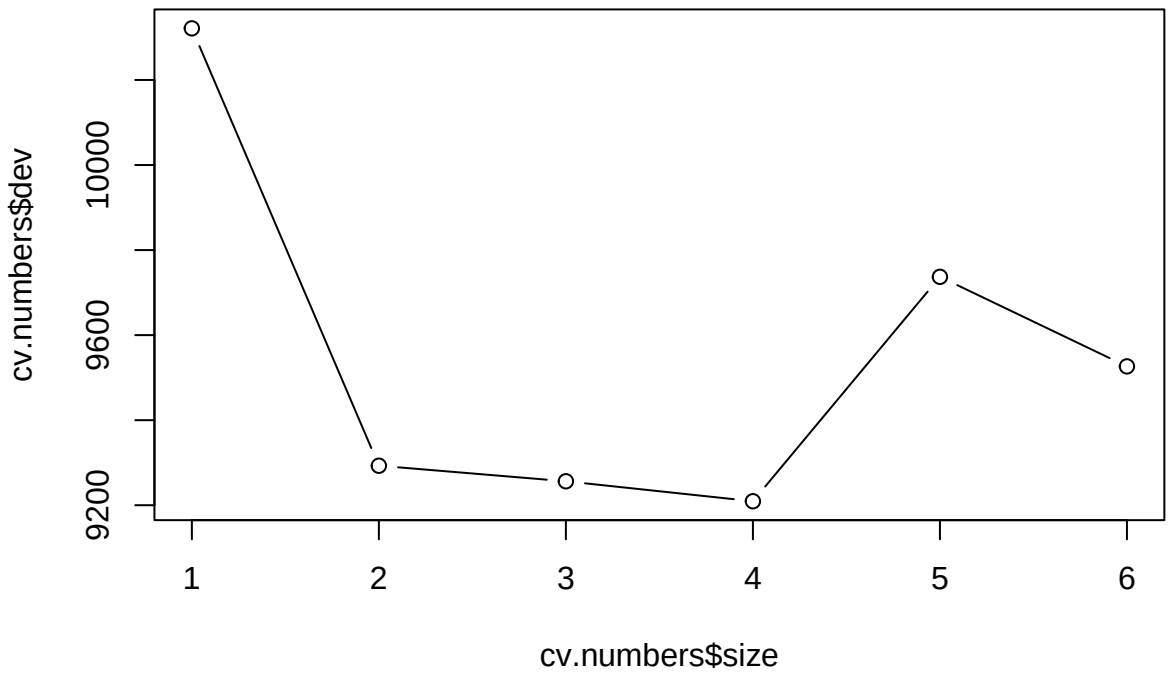
```
set.seed(4)
train <- sample(1:nrow(sesame), nrow(sesame)/2)
tree.nums <- tree(diffnumb ~ site + viewcat, sesame, subset = train)
summary(tree.nums)
```

```
##
## Regression tree:
## tree(formula = diffnumb ~ site + viewcat, data = sesame, subset = train)
## Number of terminal nodes:  6
## Residual mean deviance:  68.81 = 7844 / 114
## Distribution of residuals:
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -43.0000  -5.0120  -0.4154   0.0000   5.0980  23.0000
```

```
plot(tree.nums)
title(main ="Prediction Tree of Number Test Score Improvement")
text(tree.nums, pretty = 0)
```




```
cv.numbers <- cv.tree(tree.nums)
plot(cv.numbers$size, cv.numbers$dev, type = "b")
```

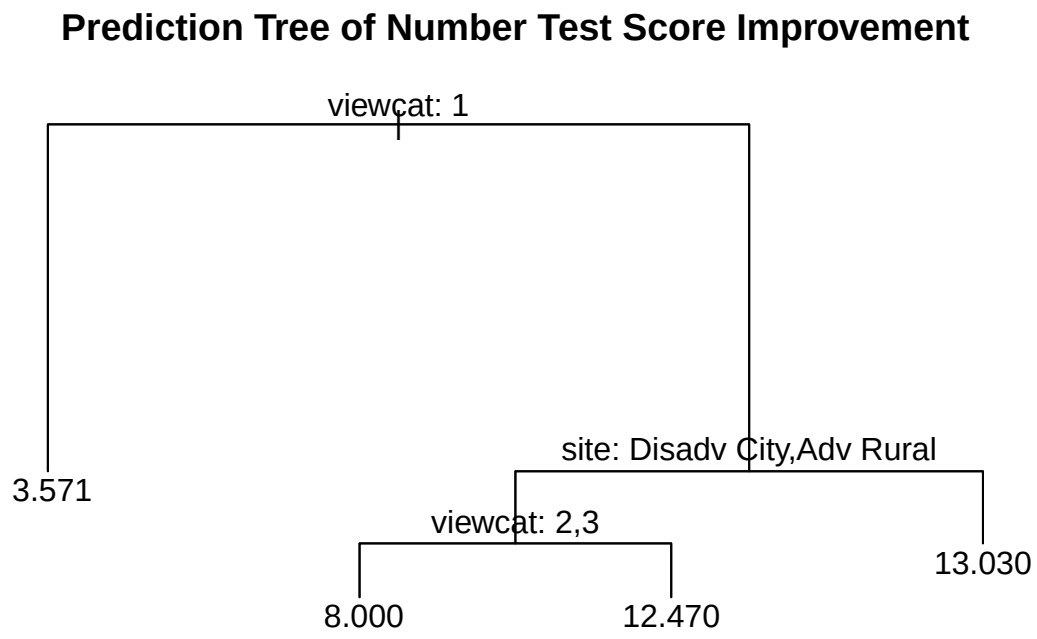


Here, the optimal nodes determined by cross validation is 4.

```
prune.numbers <- prune.tree(tree.nums, best = 4)
summary(prune.numbers)
```

```
##
## Regression tree:
## snip.tree(tree = tree.nums, nodes = c(2L, 7L))
## Number of terminal nodes:  4
## Residual mean deviance:  69.87 = 8105 / 116
## Distribution of residuals:
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -43.0000  -4.6790   0.4286   0.0000   5.5640  23.0000
```

```
plot(prune.numbers)
title(main = "Prediction Tree of Number Test Score Improvement")
text(prune.numbers, pretty = 0)
```




```
yhat <- predict(prune.numbers, newdata = sesame[-train,])
num.test <- sesame[-train, "diffnumb"]
testing <- lst(num.test)
#plot(yhat, testing)
#abline(0,1)
```

Ok so I fit the two trees above with site (which is the level of how economically disadvantaged the children are) and viewcat (which is how frequently they watch Sesame Street).

The other way that we had proposed answering this question was through GAMs. So this is what I worked with on those...

Random Forest and Boosting

```
set.seed(2)
train <- sample(1:nrow(sesame), nrow(sesame)*.7)
sesame.test <- sesame[-train,]
```

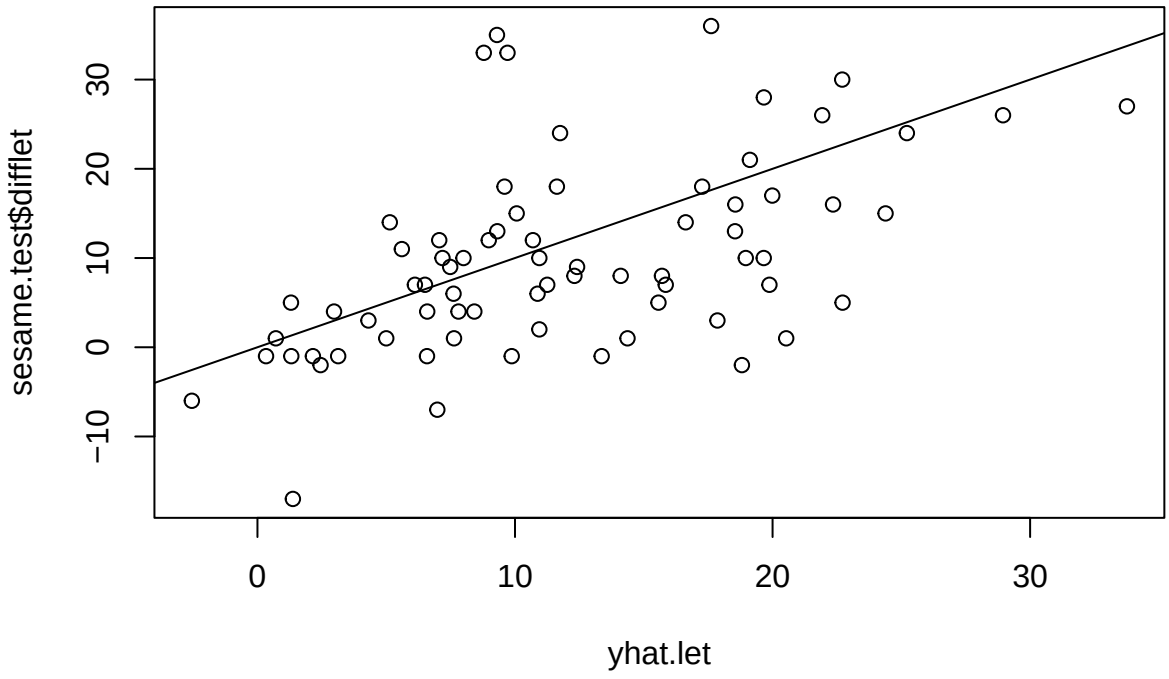
```
library(randomForest)
```

```
## randomForest 4.7-1.1

## Type rfNews() to see new features/changes/bug fixes.

##
## Attaching package: 'randomForest'
```

```
## The following object is masked from 'package:dplyr':
##
##     combine

## The following object is masked from 'package:ggplot2':
##
##     margin
```

```
set.seed(1)
bag.sesame.let <- randomForest(difflet ~ site + sex + age + viewcat + setting + viewenc + prelet,
                               data = sesame, subset = train, mtry = 7, importance = TRUE)
bag.sesame.numb <- randomForest(diffnumb ~ site + sex + age + viewcat + setting + viewenc +
                                  prenumb, data = sesame, subset = train, mtry = 7, importance = TRUE)
```

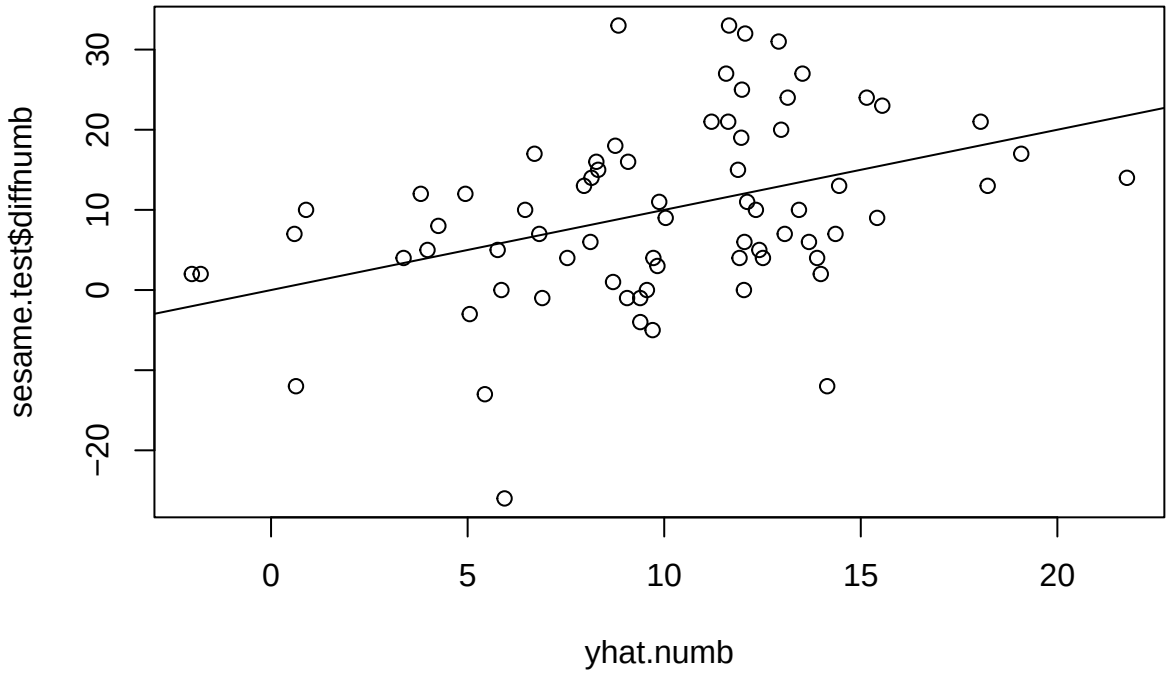
```
yhat.let <- predict(bag.sesame.let, newdata = sesame.test)
plot(yhat.let, sesame.test$difflet)
abline(0,1)
```




```
mean((yhat.let - sesame.test$difflet)^2)
```

```
## [1] 88.51915
```

```
yhat.numb <- predict(bag.sesame.numb, newdata = sesame.test)
plot(yhat.numb, sesame.test$diffnumb)
abline(0,1)
```




```
mean((yhat.numb - sesame.test$diffnumb)^2)
```

```
## [1] 107.5757
```

```
# Check basic linear models for prediction accuracy
q3_let <- lm(difflet ~ viewcat + site + sex + age + setting + viewenc + prelet, data = sesame, subset =
q3_numb <- lm(diffnumb ~ viewcat + site + sex + age + setting + viewenc + prenumb, data = sesame, subse
```

```
# Look at MSPE for linear models
pred_let <- predict(q3_let, newdata = sesame.test)
mean((pred_let - sesame.test$difflet)^2)
```

```
## [1] 78.3376
```

```
pred_numb <- predict(q3_numb, newdata = sesame.test)
mean((pred_numb - sesame.test$diffnumb)^2)
```

```
## [1] 99.73218
```

```
library(gbm)
```

```
## Loaded gbm 2.1.8.1
```

```
boost.sesame.let <- gbm(difflet ~ site + sex + age + viewcat + setting + viewenc + prelet, data =
                      sesame[train,], distribution = "gaussian", n.trees = 5000,
                      interaction.depth = 3)
yhat.boost.let <- predict(boost.sesame.let, newdata = sesame.test, n.trees = 5000)
mean((yhat.boost.let - sesame.test$difflet)^2)
```

```
## [1] 156.7586
```

```
boost.sesame.numb <- gbm(diffnumb ~ site + sex + age + viewcat + setting + viewenc + prenumb,
                         data= sesame[train,], distribution = "gaussian", n.trees = 5000,
                      interaction.depth = 3)
yhat.boost.numb <- predict(boost.sesame.numb, newdata = sesame.test, n.trees = 5000)
mean((yhat.boost.numb - sesame.test$diffnumb)^2)
```

```
## [1] 181.085
```

```
#In the lab I was looking at it just did not explain why the degrees of freedom were chosen, but I did
#There are 5 sites and 4 viewcats
library(gam)
```

```
## Loading required package: splines
```

```
## Loading required package: foreach
```

```
##
## Attaching package: 'foreach'
```

```
## The following objects are masked from 'package:purrr':
##
##     accumulate, when
```

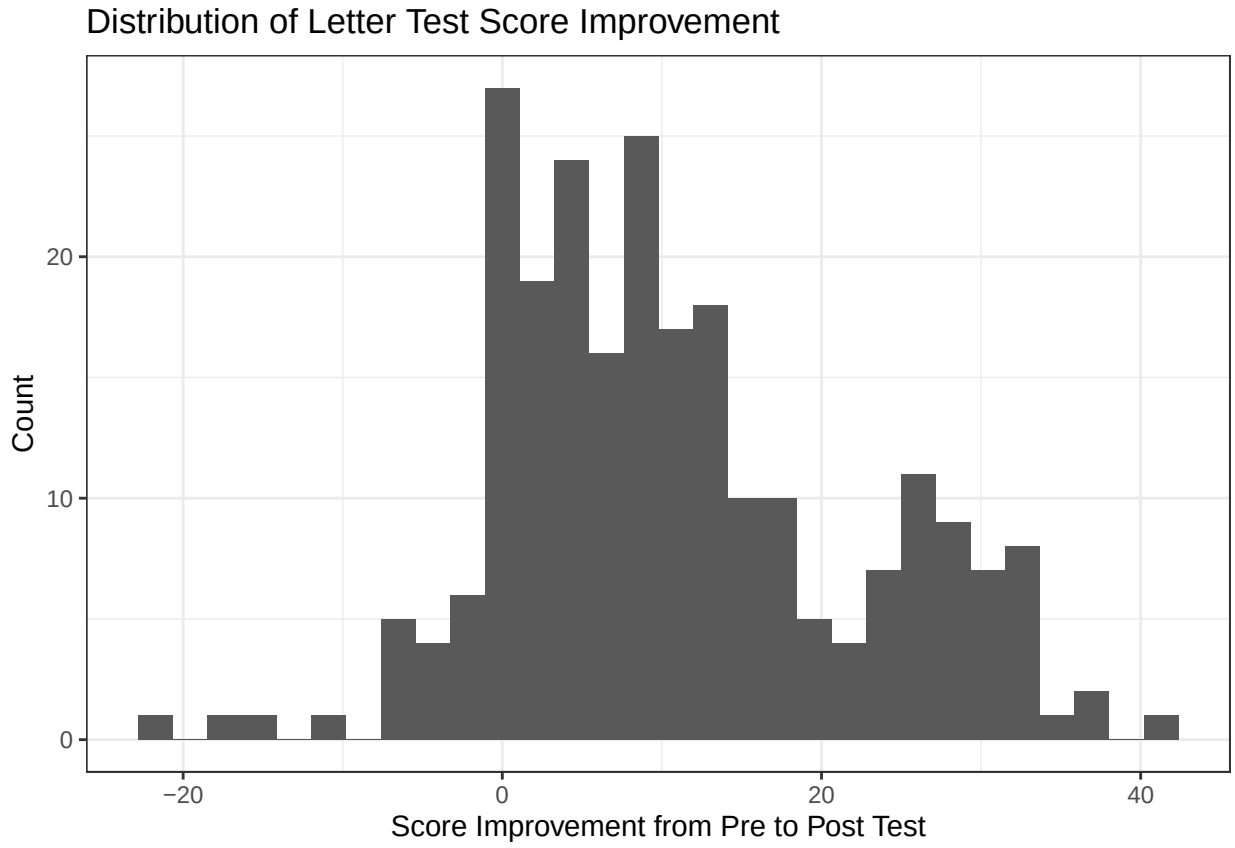
```
## Loaded gam 1.20.2
```

```
#gam.lets <- gam(difflet ~ ns(site, 6) + ns(viewcat, 5), data = sesame1)
#gam.nums <- gam(diffnumb ~ ns(site, 6) + ns(viewcat, 5), data = sesame1)
#summary(gam.lets)
#summary(gam.nums)

#I keep getting this error
#Error in (1 - h) * qs[i] : non-numeric argument to binary operator
```

Some more EDA stuff...

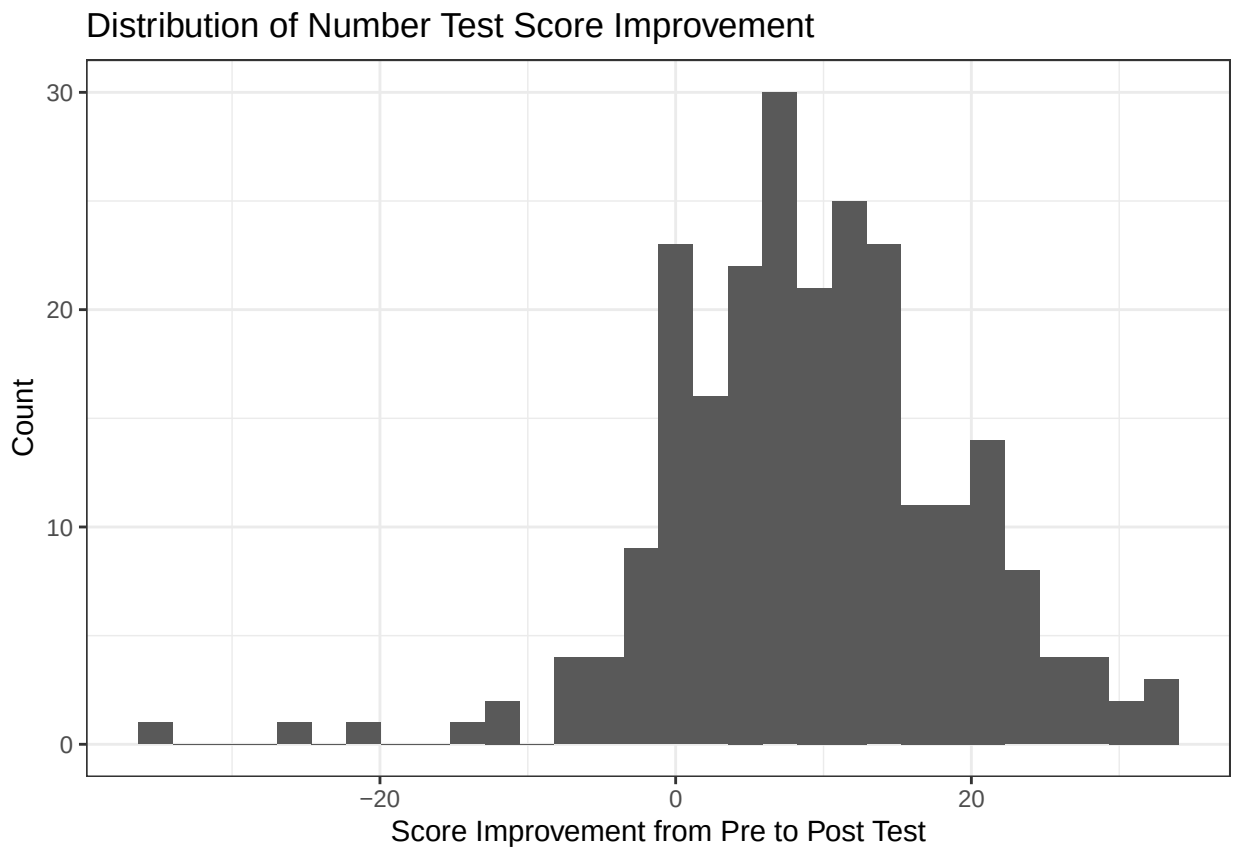
```
ggplot(sesame, aes(x = difflet)) + geom_histogram() + theme_bw() + labs(title = "Distribution of Letter
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```




```
ggplot(sesame, aes(x = diffnumb)) + geom_histogram() + theme_bw() + labs(title = "Distribution of Numbe
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Question 1 - Lasso Selection:

```
head(sesame)
```

```
## # A tibble: 6 x 34
##   rowna~1    id site  sex     age viewcat setting viewenc prebody prelet preform
##     <dbl> <dbl> <fct> <fct> <dbl> <fct>   <fct>   <fct>     <dbl>  <dbl>   <dbl>
## 1       1     1 Disa~ 1        66 1       2       1            16     23      12
## 2       2     2 Disa~ 2        67 3       2       1            30     26       9
## 3       3     3 Disa~ 1        56 3       2       2            22     14       9
## 4       4     4 Disa~ 1        49 1       2       2            23     11      10
## 5       5     5 Disa~ 1        69 4       2       2            32     47      15
## 6       6     6 Disa~ 2        54 3       2       2            29     26      10
## # ... with 23 more variables: prenumb <dbl>, prerelat <dbl>, preclasf <dbl>,
## #   postbody <dbl>, postlet <dbl>, postform <dbl>, postnumb <dbl>,
## #   postrelat <dbl>, postclasf <dbl>, peabody <dbl>, agecat <dbl>,
## #   encour <dbl>, `_Isite_2` <dbl>, `_Isite_3` <dbl>, `_Isite_4` <dbl>,
## #   `_Isite_5` <dbl>, regular <fct>, diffbody <dbl>, difflet <dbl>,
## #   diffform <dbl>, diffnumb <dbl>, diffrelat <dbl>, diffclasf <dbl>, and
## #   abbreviated variable name 1: rownames
```

```
myvars <- c("site", "sex", "age", "viewcat", "setting", "viewenc", "regular", "difflet")
let_lasso_data <- sesame[myvars]
head(let_lasso_data)
```

```
## # A tibble: 6 x 8
```

```
##   site        sex     age viewcat setting viewenc regular difflet
##   <fct>       <fct> <dbl> <fct>   <fct>   <fct>   <fct>     <dbl>
## 1 Disadv City 1        66 1       2       1       0             7
## 2 Disadv City 2        67 3       2       1       1            11
## 3 Disadv City 1        56 3       2       2       1            32
## 4 Disadv City 1        49 1       2       2       0             3
## 5 Disadv City 1        69 4       2       2       1            16
## 6 Disadv City 2        54 3       2       2       1            10
```

```
library(glmnet)
```

```
## Loading required package: Matrix
```

```
##
## Attaching package: 'Matrix'
```

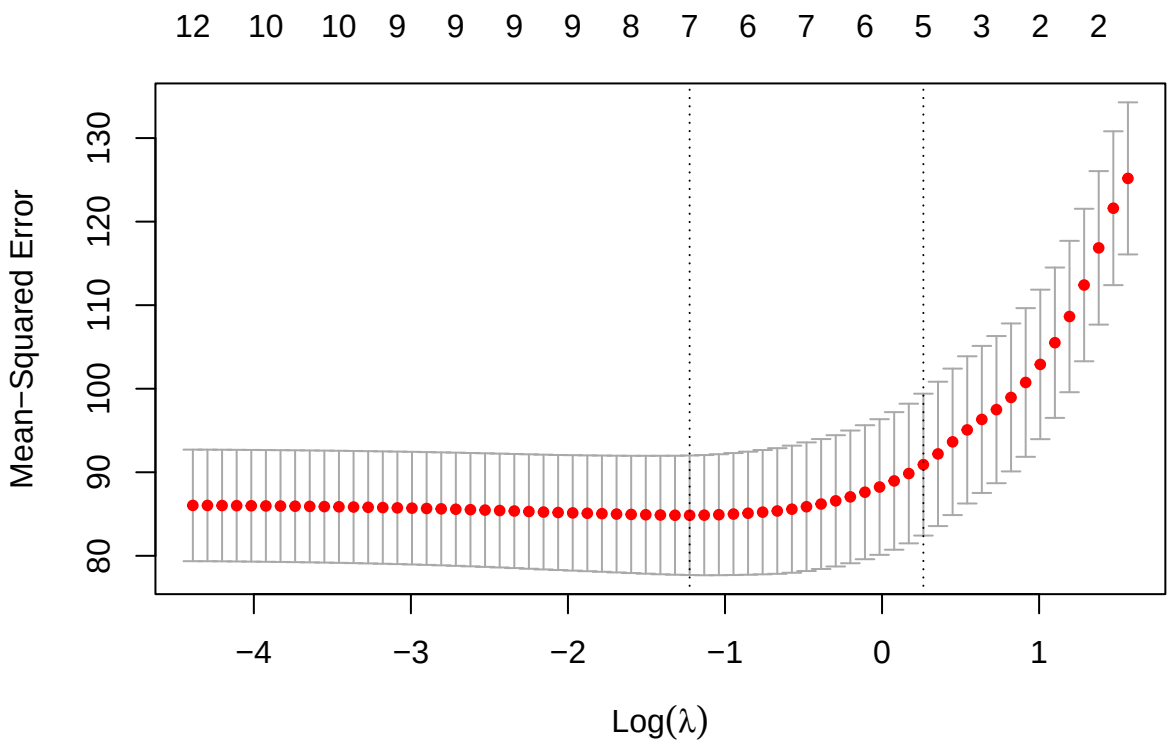
```
## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack
```

```
## Loaded glmnet 4.1-4
```

```
x <- model.matrix (difflet~.,let_lasso_data)[,-1]
y <- let_lasso_data$difflet

#perform k-fold cross-validation to find optimal lambda value
cv_model <- cv.glmnet(x, y, alpha = 1)

#find optimal lambda value that minimizes test MSE
best_lambda <- cv_model$lambda.min
best_lambda
```

```
## [1] 0.2936653
```

```
#produce plot of test MSE by lambda value
plot(cv_model)
```




```
#get coefs of best model
best_model <- glmnet(x, y, alpha = 1, lambda = best_lambda)
coef(best_model)
```

```
## 13 x 1 sparse Matrix of class "dgCMatrix"
##                              s0
## (Intercept)          1.63990012
## siteAdv Sub          7.09482693
## siteAdv Rural       -3.50586196
## siteDisadv Rural     .
## siteDisadv Spanish   .
## sex2                 0.17858277
## age                  0.05618272
## viewcat2            -5.10979732
## viewcat3             .
## viewcat4             .
## setting2             .
## viewenc2            -1.83172244
## regular1             9.59292859
```

```
myvars2 <- c("site", "sex", "age", "viewcat", "setting", "viewenc", "regular", "diffnumb")
numb_lasso_data <- sesame[myvars2]
head(numb_lasso_data)
```

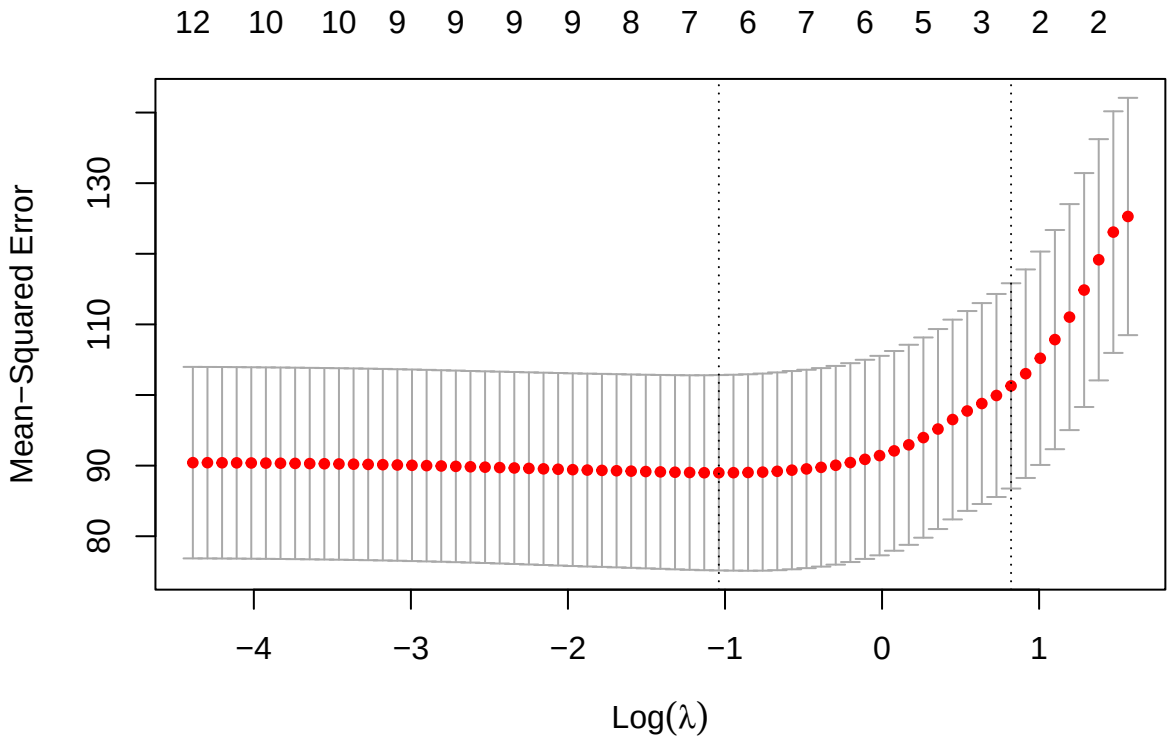
```
## # A tibble: 6 x 8
```

```
##   site         sex     age viewcat setting viewenc regular diffnumb
##   <fct>        <fct> <dbl> <fct>   <fct>   <fct>   <fct>      <dbl>
## 1 Disadv City 1        66 1       2       1       0              4
## 2 Disadv City 2        67 3       2       1       1              0
## 3 Disadv City 1        56 3       2       2       1             31
## 4 Disadv City 1        49 1       2       2       0              5
## 5 Disadv City 1        69 4       2       2       1              3
## 6 Disadv City 2        54 3       2       2       1              6
```

```
x2 <- model.matrix (diffnumb~.,numb_lasso_data)[,-1]
y2 <- numb_lasso_data$diffnumb

#perform k-fold cross-validation to find optimal lambda value
cv_model <- cv.glmnet(x, y, alpha = 1)

#find optimal lambda value that minimizes test MSE
best_lambda <- cv_model$lambda.min
best_lambda
```

```
## [1] 0.3537209
```

```
#produce plot of test MSE by lambda value
plot(cv_model)
```



```r
#get coefs of best model
best_model <- glmnet(x, y, alpha = 1, lambda = best_lambda)
coef(best_model)
```

```
## 13 x 1 sparse Matrix of class "dgCMatrix"
##                              s0
## (Intercept)          2.24712292
## siteAdv Sub          7.06196539
## siteAdv Rural       -3.34213707
## siteDisadv Rural     .
## siteDisadv Spanish   .
## sex2                 0.04201132
## age                  0.04550848
## viewcat2            -4.91899253
## viewcat3             .
## viewcat4             .
## setting2             .
## viewenc2            -1.69859956
## regular1             9.43971067
```