

```
ltelddf[ltelddf$Year == "2016-17",]$Year <- 2016
ltelddf[ltelddf$Year == "2017-18",]$Year <- 2017
ltelddf[ltelddf$Year == "2018-19",]$Year <- 2018
ltelddf[ltelddf$Year == "2021-22",]$Year <- 2021
ltelddf[ltelddf$Year == "2022-23",]$Year <- 2022
ltelddf[ltelddf$Year == "2023-24",]$Year <- 2023
ltelddf$Year <- as.integer(ltelddf$Year)
```

Warning: NAs introduced by coercion

```
ltel_joined_df <- inner_join(total, ltelddf, by = c("cdsCode", "Year"))
```

Warning in inner_join(total, ltelddf, by = c("cdsCode", "Year")): Detected an unexpected many-to-many relationship between `x` and `y`.

• Row 11 of `x` matches multiple rows in `y`.

• Row 38058 of `y` matches multiple rows in `x`.

• If a many-to-many relationship is expected, set `relationship = "many-to-many"` to silence this warning.

```
ltel_modelGrad <- lmer(RegHSDiplomaRate ~ Year + RFEP + IFEP + EO + EL + AR + LTEL + EL4 + EL03Y +
  data = ltel_joined_df)
```

fixed-effect model matrix is rank deficient so dropping 3 columns / coefficients

```
summary(ltel_modelGrad)
```

Linear mixed model fit by REML ['lmerMod']

Formula: RegHSDiplomaRate ~ Year + RFEP + IFEP + EO + EL + AR + LTEL + EL4 + EL03Y + EL45Y + EL6 + EverEL + (1 | cdsCode)

Data: ltel_joined_df

REML criterion at convergence: 671738.1

Scaled residuals:

| Min | 1Q | Median | 3Q | Max |
|----------|---------|--------|--------|--------|
| -10.8514 | -0.3674 | 0.0468 | 0.3174 | 8.8556 |

Random effects:

| Groups | Name | Variance | Std.Dev. |
|----------|-------------|----------|----------|
| cdsCode | (Intercept) | 553.4 | 23.524 |
| Residual | | 46.3 | 6.804 |

Number of obs: 98826, groups: cdsCode, 1932

Fixed effects:

| | Estimate | Std. Error | t value |
|-------------|------------|------------|---------|
| (Intercept) | -1.927e+03 | 2.181e+01 | -88.343 |
| Year | 9.914e-01 | 1.080e-02 | 91.826 |

| | | | |
|-------|------------|-----------|--------|
| RFEP | 1.290e-02 | 1.279e-03 | 10.082 |
| IFEP | 4.461e-02 | 3.205e-03 | 13.918 |
| EO | 1.367e-02 | 9.892e-04 | 13.821 |
| EL | 1.424e-04 | 4.572e-03 | 0.031 |
| AR | -2.874e-01 | 4.116e-02 | -6.984 |
| LTEL | -1.886e-02 | 5.222e-03 | -3.612 |
| EL4 | -2.319e-02 | 5.724e-03 | -4.052 |
| EL45Y | 1.124e-01 | 3.949e-02 | 2.846 |

Correlation of Fixed Effects:

| | (Intr) | Year | RFEP | IFEP | EO | EL | AR | LTEL | EL4 |
|-------|--------|--------|--------|--------|--------|--------|--------|-------|--------|
| Year | -1.000 | | | | | | | | |
| RFEP | -0.059 | 0.057 | | | | | | | |
| IFEP | -0.202 | 0.200 | -0.023 | | | | | | |
| EO | -0.054 | 0.050 | -0.257 | -0.056 | | | | | |
| EL | -0.038 | 0.037 | -0.112 | -0.016 | 0.011 | | | | |
| AR | 0.093 | -0.093 | -0.031 | 0.029 | -0.008 | -0.085 | | | |
| LTEL | 0.057 | -0.056 | 0.076 | 0.054 | -0.140 | -0.914 | 0.066 | | |
| EL4 | 0.034 | -0.033 | 0.134 | 0.027 | -0.134 | -0.815 | 0.312 | 0.799 | |
| EL45Y | -0.025 | 0.025 | 0.034 | -0.034 | 0.002 | -0.037 | -0.928 | 0.027 | -0.198 |

fit warnings:

fixed-effect model matrix is rank deficient so dropping 3 columns / coefficients

```
ltel_modelUni <- lmer(UniReqsPercent ~ Year + RFEP + IFEP + EO + EL + AR + LTEL + EL4 + EL03Y + E
                        data = ltel_joined_df)
```

fixed-effect model matrix is rank deficient so dropping 3 columns / coefficients

```
summary(ltel_modelUni)
```

Linear mixed model fit by REML ['lmerMod']
Formula: UniReqsPercent ~ Year + RFEP + IFEP + EO + EL + AR + LTEL + EL4 +
EL03Y + EL45Y + EL6 + EverEL + (1 | cdsCode)
Data: ltel_joined_df

REML criterion at convergence: 712247.3

Scaled residuals:

| | | | | |
|----------|---------|--------|--------|--------|
| Min | 1Q | Median | 3Q | Max |
| -10.7175 | -0.2764 | 0.0037 | 0.2952 | 9.1627 |

Random effects:

| Groups | Name | Variance | Std.Dev. |
|---|-------------|----------|----------|
| cdsCode | (Intercept) | 715.08 | 26.741 |
| Residual | | 69.97 | 8.365 |
| Number of obs: 98826, groups: cdsCode, 1932 | | | |

Fixed effects:

| Estimate | Std. Error | t value |
|----------|------------|---------|
|----------|------------|---------|

| | | | |
|-------------|------------|-----------|---------|
| (Intercept) | -7.010e+02 | 2.681e+01 | -26.152 |
| Year | 3.627e-01 | 1.327e-02 | 27.333 |
| RFEP | 4.797e-03 | 1.569e-03 | 3.057 |
| IFEP | 7.116e-03 | 3.936e-03 | 1.808 |
| EO | 1.163e-02 | 1.210e-03 | 9.613 |
| EL | 7.543e-05 | 5.618e-03 | 0.013 |
| AR | 1.968e-01 | 5.060e-02 | 3.889 |
| LTEL | -1.579e-02 | 6.417e-03 | -2.461 |
| EL4 | -1.223e-02 | 7.034e-03 | -1.739 |
| EL45Y | -1.953e-01 | 4.855e-02 | -4.024 |

Correlation of Fixed Effects:

| | (Intr) | Year | RFEP | IFEP | EO | EL | AR | LTEL | EL4 |
|-------|--------|--------|--------|--------|--------|--------|--------|-------|--------|
| Year | -1.000 | | | | | | | | |
| RFEP | -0.059 | 0.057 | | | | | | | |
| IFEP | -0.201 | 0.200 | -0.024 | | | | | | |
| EO | -0.053 | 0.049 | -0.258 | -0.058 | | | | | |
| EL | -0.038 | 0.037 | -0.112 | -0.017 | 0.011 | | | | |
| AR | 0.093 | -0.093 | -0.031 | 0.029 | -0.008 | -0.085 | | | |
| LTEL | 0.057 | -0.056 | 0.076 | 0.055 | -0.139 | -0.914 | 0.066 | | |
| EL4 | 0.034 | -0.033 | 0.134 | 0.028 | -0.133 | -0.815 | 0.312 | 0.799 | |
| EL45Y | -0.025 | 0.025 | 0.034 | -0.034 | 0.002 | -0.037 | -0.928 | 0.027 | -0.197 |

fit warnings:
fixed-effect model matrix is rank deficient so dropping 3 columns / coefficients

```
r2(ltel_modelGrad)
```

R2 for Mixed Models

Conditional R2: 0.925
Marginal R2: 0.022

```
r2(ltel_modelUni)
```

R2 for Mixed Models

Conditional R2: 0.911
Marginal R2: 0.005

```
head(eladf)
```

| | cdsCode | currstatus | Year |
|---|---------------|------------|------|
| 1 | 1316090131755 | -116.2 | 2023 |
| 2 | 1316090131755 | -119.1 | 2023 |
| 3 | 1316090131755 | -116.2 | 2023 |
| 4 | 1316170131763 | -67.5 | 2023 |
| 5 | 1316170131763 | -95.8 | 2023 |
| 6 | 1316170131763 | 29.5 | 2023 |

| | | | |
|---------------------|------------|-----------|--------|
| ReportingCategoryRB | 1.220e-01 | 1.487e-01 | 0.821 |
| ReportingCategoryRD | 6.096e-01 | 2.996e-01 | 2.034 |
| ReportingCategoryRF | -4.178e-03 | 1.710e-01 | -0.024 |
| ReportingCategoryRH | -7.097e-02 | 1.174e-01 | -0.604 |
| ReportingCategoryRI | -1.734e-01 | 3.485e-01 | -0.498 |
| ReportingCategoryRP | -1.451e-01 | 3.179e-01 | -0.457 |
| ReportingCategoryRT | 7.501e-02 | 1.569e-01 | 0.478 |
| ReportingCategoryRW | 6.075e-02 | 1.230e-01 | 0.494 |
| ReportingCategorySD | 9.909e-02 | 1.260e-01 | 0.786 |
| ReportingCategorySE | -6.614e-03 | 1.260e-01 | -0.052 |
| ReportingCategorySF | -1.310e-01 | 2.369e-01 | -0.553 |
| ReportingCategorySH | -1.954e-01 | 1.365e-01 | -1.431 |
| ReportingCategorySM | -4.808e-02 | 2.324e-01 | -0.207 |
| ReportingCategorySS | -3.060e-02 | 1.152e-01 | -0.266 |
| CPPRate | 4.100e-02 | 2.843e-02 | 1.442 |
| OtherRate | 7.530e-03 | 3.051e-03 | 2.468 |

Correlation matrix not shown by default, as $p = 25 > 12$.

Use `print(x, correlation=TRUE)` or
`vcov(x)` if you need it

```
ltelMath <- inner_join(ltel_joined_df, mdf, by = c("cdsCode", "Year"))
```

Warning in `inner_join(ltel_joined_df, mdf, by = c("cdsCode", "Year"))`: Detected an unexpected many-to-many relationship between `x` and `y`.

• Row 9 of `x` matches multiple rows in `y`.
 • Row 4 of `y` matches multiple rows in `x`.
 • If a many-to-many relationship is expected, set `relationship = "many-to-many"` to silence this warning.

```
ltelELA <- inner_join(ltel_joined_df, eladf, by = c("cdsCode", "Year"))
```

Warning in `inner_join(ltel_joined_df, eladf, by = c("cdsCode", "Year"))`: Detected an unexpected many-to-many relationship between `x` and `y`.

• Row 9 of `x` matches multiple rows in `y`.
 • Row 4 of `y` matches multiple rows in `x`.
 • If a many-to-many relationship is expected, set `relationship = "many-to-many"` to silence this warning.

```
ltel_modelMath <- lmer(currstatus ~ Year + RFEP + IFEP + EO + EL + AR + LTEL + EL4 + EL03Y + EL45,
  data = ltelMath)
```

fixed-effect model matrix is rank deficient so dropping 3 columns / coefficients

```
summary(ltel_modelMath)
```

Linear mixed model fit by REML ['lmerMod']
Formula: currstatus ~ Year + RFEP + IFEP + EO + EL + AR + LTEL + EL4 +
EL03Y + EL45Y + EL6 + EverEL + (1 | cdsCode)
Data: ltelMath

REML criterion at convergence: 7317524

Scaled residuals:

| Min | 1Q | Median | 3Q | Max |
|---------|---------|--------|--------|--------|
| -5.3347 | -0.6078 | 0.1316 | 0.6169 | 4.8167 |

Random effects:

| Groups | Name | Variance | Std.Dev. |
|----------|-------------|----------|----------|
| cdsCode | (Intercept) | 3338 | 57.77 |
| Residual | | 3143 | 56.06 |

Number of obs: 671179, groups: cdsCode, 1273

Fixed effects:

| | Estimate | Std. Error | t value |
|-------------|------------|------------|----------|
| (Intercept) | 8.359e+03 | 6.822e+01 | 122.523 |
| Year | -4.189e+00 | 3.375e-02 | -124.132 |
| RFEP | -1.214e-03 | 3.380e-03 | -0.359 |
| IFEP | -6.970e-02 | 8.084e-03 | -8.622 |
| EO | 2.821e-02 | 2.636e-03 | 10.704 |
| EL | 1.144e-02 | 1.185e-02 | 0.965 |
| AR | 8.994e-01 | 1.017e-01 | 8.840 |
| LTEL | -5.079e-02 | 1.379e-02 | -3.684 |
| EL4 | -2.009e-01 | 1.493e-02 | -13.459 |
| EL45Y | -7.688e-01 | 9.731e-02 | -7.900 |

Correlation of Fixed Effects:

| | (Intr) | Year | RFEP | IFEP | EO | EL | AR | LTEL | EL4 |
|-------|--------|--------|--------|--------|--------|--------|--------|-------|--------|
| Year | -1.000 | | | | | | | | |
| RFEP | -0.103 | 0.099 | | | | | | | |
| IFEP | -0.244 | 0.242 | 0.035 | | | | | | |
| EO | -0.088 | 0.083 | -0.186 | -0.010 | | | | | |
| EL | -0.055 | 0.055 | -0.120 | -0.022 | 0.005 | | | | |
| AR | 0.121 | -0.122 | -0.022 | 0.033 | -0.006 | -0.096 | | | |
| LTEL | 0.077 | -0.077 | 0.116 | 0.074 | -0.114 | -0.906 | 0.082 | | |
| EL4 | 0.061 | -0.061 | 0.170 | 0.048 | -0.115 | -0.818 | 0.321 | 0.812 | |
| EL45Y | -0.032 | 0.032 | 0.028 | -0.042 | 0.000 | -0.036 | -0.922 | 0.020 | -0.197 |

fit warnings:
fixed-effect model matrix is rank deficient so dropping 3 columns / coefficients

```
ltel_modelELA <- lmer(currstatus ~ Year + RFEP + IFEP + EO + EL + AR + LTEL + EL4 + EL03Y + EL45Y
                        data = ltelELA)
```

fixed-effect model matrix is rank deficient so dropping 3 columns / coefficients

```
summary(ltel_modelELA)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: currstatus ~ Year + RFEP + IFEP + EO + EL + AR + LTEL + EL4 +
  EL03Y + EL45Y + EL6 + EverEL + (1 | cdsCode)
Data: ltelELA
```

REML criterion at convergence: 7334334

Scaled residuals:

| | Min | 1Q | Median | 3Q | Max |
|--|---------|---------|--------|--------|--------|
| | -5.9808 | -0.6367 | 0.2057 | 0.6873 | 3.6899 |

Random effects:

| Groups | Name | Variance | Std.Dev. |
|----------|-------------|----------|----------|
| cdsCode | (Intercept) | 2699 | 51.95 |
| Residual | | 3191 | 56.49 |

Number of obs: 671818, groups: cdsCode, 1274

Fixed effects:

| | Estimate | Std. Error | t value |
|-------------|------------|------------|---------|
| (Intercept) | 6.723e+03 | 6.873e+01 | 97.812 |
| Year | -3.339e+00 | 3.400e-02 | -98.209 |
| RFEP | -3.989e-02 | 3.393e-03 | -11.757 |
| IFEP | -6.621e-02 | 8.132e-03 | -8.142 |
| EO | 2.263e-02 | 2.636e-03 | 8.584 |
| EL | -4.012e-02 | 1.195e-02 | -3.359 |
| AR | 7.362e-01 | 1.025e-01 | 7.181 |
| LTEL | 3.000e-02 | 1.389e-02 | 2.159 |
| EL4 | -7.600e-02 | 1.504e-02 | -5.054 |
| EL45Y | -6.834e-01 | 9.806e-02 | -6.970 |

Correlation of Fixed Effects:

| | (Intr) | Year | RFEP | IFEP | EO | EL | AR | LTEL | EL4 |
|-------|--------|--------|--------|--------|--------|--------|--------|-------|--------|
| Year | -1.000 | | | | | | | | |
| RFEP | -0.102 | 0.099 | | | | | | | |
| IFEP | -0.244 | 0.242 | 0.033 | | | | | | |
| EO | -0.087 | 0.082 | -0.187 | -0.012 | | | | | |
| EL | -0.055 | 0.055 | -0.121 | -0.023 | 0.006 | | | | |
| AR | 0.121 | -0.121 | -0.022 | 0.033 | -0.006 | -0.096 | | | |
| LTEL | 0.077 | -0.077 | 0.116 | 0.075 | -0.114 | -0.906 | 0.082 | | |
| EL4 | 0.061 | -0.061 | 0.169 | 0.049 | -0.114 | -0.819 | 0.321 | 0.812 | |
| EL45Y | -0.032 | 0.031 | 0.028 | -0.043 | 0.000 | -0.036 | -0.922 | 0.020 | -0.197 |

fit warnings:
fixed-effect model matrix is rank deficient so dropping 3 columns / coefficients

```
r2(ltel_modelMath)
```

R2 for Mixed Models

Conditional R2: 0.523

Marginal R2: 0.017

```
r2(ltel_modelELA)
```

R2 for Mixed Models

Conditional R2: 0.466

Marginal R2: 0.014

```
library(broom.mixed)
library(ggplot2)
library(cowplot)
# Tidy the model
tidy_coefs <- broom.mixed::tidy(glmmm_modelGrad, effects = "fixed", conf.int = TRUE)
tidy_coefs_no_intercept <- tidy_coefs %>%
  filter(term != "(Intercept)") %>%
  mutate(
    term = case_when(
      term == "ReportingCategoryRB" ~ "African American",
      term == "ReportingCategoryRI" ~ "American Indian or Alaska Native",
      term == "ReportingCategoryRA" ~ "Asian",
      term == "ReportingCategoryRF" ~ "Filipino",
      term == "ReportingCategoryRH" ~ "Hispanic or Latino",
      term == "ReportingCategoryRD" ~ "Not Reported Race",
      term == "ReportingCategoryRP" ~ "Pacific Islander",
      term == "ReportingCategoryRT" ~ "Two or More Races",
      term == "ReportingCategoryRW" ~ "White",
      term == "ReportingCategoryGM" ~ "Male",
      term == "ReportingCategoryGF" ~ "Female",
      term == "ReportingCategoryGX" ~ "Non-Binary",
      term == "ReportingCategorySE" ~ "English Learners",
      term == "ReportingCategorySD" ~ "Students with Disabilities",
      term == "ReportingCategorySS" ~ "Socioeconomically Disadvantaged",
      term == "ReportingCategorySM" ~ "Migrant",
      term == "ReportingCategorySF" ~ "Foster",
      term == "ReportingCategorySH" ~ "Homeless",
      TRUE ~ term
    ),
    Significance = ifelse(conf.low > 0 | conf.high < 0, "Significant", "Not Significant")
  )

p_full <- ggplot(tidy_coefs_no_intercept, aes(x = estimate, y = term, color = Significance)) +
  geom_point() +
  geom_errorbarh(aes(xmin = conf.low, xmax = conf.high)) +
  geom_vline(xintercept = 0, linetype = "dashed", color = "red") +
  scale_color_manual(values = c("Significant" = "steelblue", "Not Significant" = "gray")) +
  labs(title = "Fixed Effects on High School Graduation Rate",
```