

IDI Case Study

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```
# citations
# https://libguides.lib.miamioh.edu/data_analysis/t-test
# https://www.sthda.com/english/wiki/paired-samples-t-test-in-r
# https://r-graph-gallery.com/264-control-ggplot2-boxplot-colors.html
# https://www.geeksforgeeks.org/remove-legend-in-ggplot2-in-r/
# https://guslipkin.medium.com/reordering-bar-and-column-charts-with-ggplot2-in-r-435fad1c643e
# https://r-charts.com/part-whole/stacked-bar-chart-ggplot2/
```

Introduction

At the MSU Teacher Preparation Program, we use the Intercultural Development Inventory (IDI) as a pre- and post-measure of intercultural growth for accreditation reporting and program improvement. A significant amount of resources are allocated to administering the IDI including the cost of the individual log in codes and the time to administer the survey. Program leadership is interested in measuring the effectiveness of the IDI and finding different ways to utilize the data.

To accomplish this goal, I have compiled a report and case study of the TPP 2024 completers. Data sources include the pre- and post-scores from the IDI, survey results sent to all completers, and administrator feedback provided by the Michigan Department of Education.

```
# load data
data = read_excel("2024CompletersData.xlsx")
# includes IDI scores and one administrator response

survey = read_excel("IDISurvey.xlsx")
```

```
## New names:
## * 'IDI' -> 'IDI...27'
## * 'IDI' -> 'IDI...36'
```

```
# includes survey results
```

Exploring the Data

First, I will visualize and explore the pre- and post-results of all 2024 completers. This data only includes those students who have both pre- and post-scores. Students who either did not complete the program or were missing either a pre- and post-score were excluded.

```
nrow(data)
```

```
## [1] 199
```

This includes 199 individual students including a mix of Secondary, Elementary, and Special Education students.

The IDI produces three scores, outlined on their website here: <https://www.idiinventory.com/assessment-and-reports>

For the most part, we will be focusing on the Development Orientation for the purpose of this study.

```
# find mean and sd of the pre and post scores

# create new dataframe grouped by pre and post
prepost = data.frame(group = rep(c("Pre", "Post"), each = 199),
                      weight = c(data$PreDO, data$PostDO))

# summarise data
group_by(prepost, group) %>%
  summarise(
    mean = mean(weight, na.rm = TRUE),
    sd = sd(weight, na.rm = TRUE)
  )
```

```
## # A tibble: 2 x 3
##   group mean    sd
##   <chr> <dbl> <dbl>
## 1 Post  100.   15.5
## 2 Pre   97.7   15.6
```

Based on the averages, there was a net increase in program completers' Developmental Orientation.

```
# add categorical variable "orientation"
denial = 69.99
polar = 84.99
minim = 114.99
accept = 129.99
orients = c("Denial", "Polarization", "Minimization", "Acceptance", "Adaptation")

data$PreName <- as.factor(ifelse(data$PreDO < denial, 'Denial',
                                ifelse(data$PreDO < polar, 'Polarization',
                                ifelse(data$PreDO < minim, 'Minimization',
                                ifelse(data$PreDO < accept, 'Acceptance', 'Adaptation')))))

data$PostName <- as.factor(ifelse(data$PostDO < denial, 'Denial',
                                ifelse(data$PostDO < polar, 'Polarization',
                                ifelse(data$PostDO < minim, 'Minimization',
                                ifelse(data$PostDO < accept, 'Acceptance', 'Adaptation')))))

# combined bar graph of pre and post D orientations

# find number of pre-score DO orientations
```

```

preor = data %>% group_by(PreName) %>%
  count()

# create bar chart of pre-score DO orientations
predo = ggplot(preor, aes(x=factor(PreName, orients), y=n, fill=PreName)) +
  geom_col() +
  ylim(0, 155)+
  labs(x="",
       y="Count",
       title="Pre-Developmental Orientation Distribution") +
  geom_text(aes(label = n), vjust = -0.5, size = 3) +
  scale_fill_manual(values=c("#008208", "#0B9A6D", "#18453B", "#7BBD00", "#008934"))+
  theme_MSU() +
  guides(fill="none")

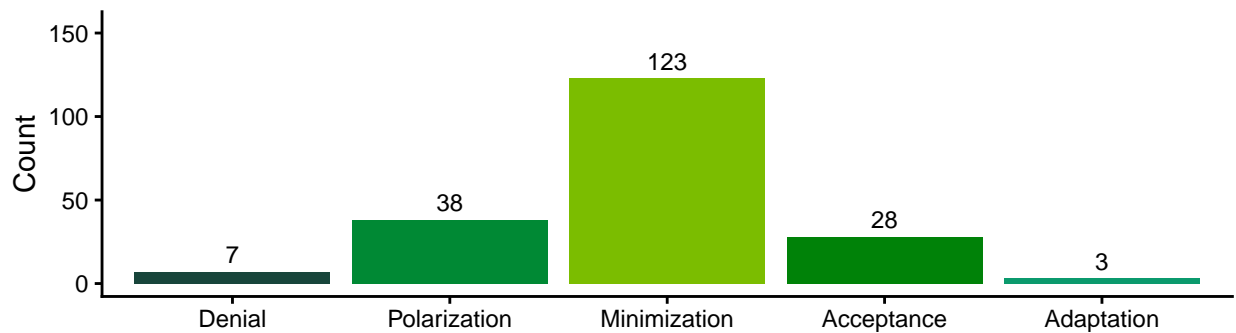
# find number of post-score DO orientations
postor = data %>% group_by(PostName) %>%
  count()

# create bar chart of post-score DO orientations
postdo = ggplot(postor, aes(x=factor(PostName, orients), y=n, fill=PostName)) +
  geom_col() +
  ylim(0, 155)+
  labs(x="",
       y="Count",
       title="Post-Developmental Orientation Distribution") +
  geom_text(aes(label = n), vjust = -0.5, size = 3) +
  scale_fill_manual(values=c("#008208", "#0B9A6D", "#18453B", "#7BBD00", "#008934"))+
  theme_MSU() +
  guides(fill="none")

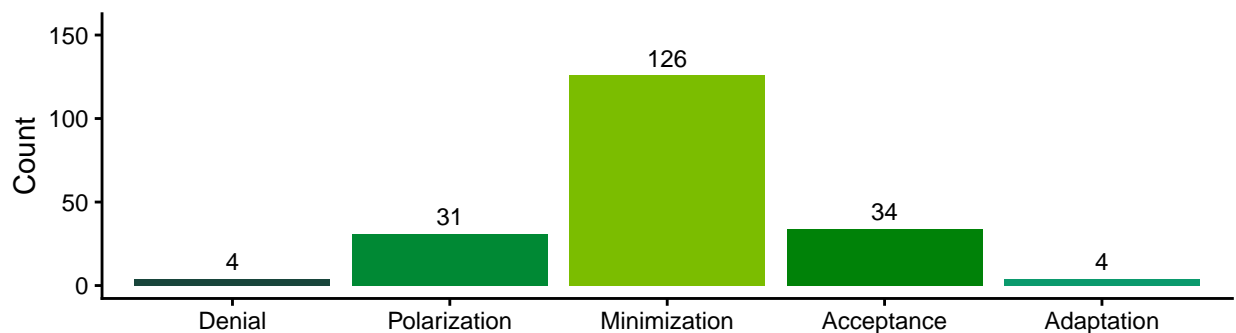
graph = grid.arrange(predo, postdo, nrow=2)

```

Pre-Developmental Orientation Distribution



Post-Developmental Orientation Distribution



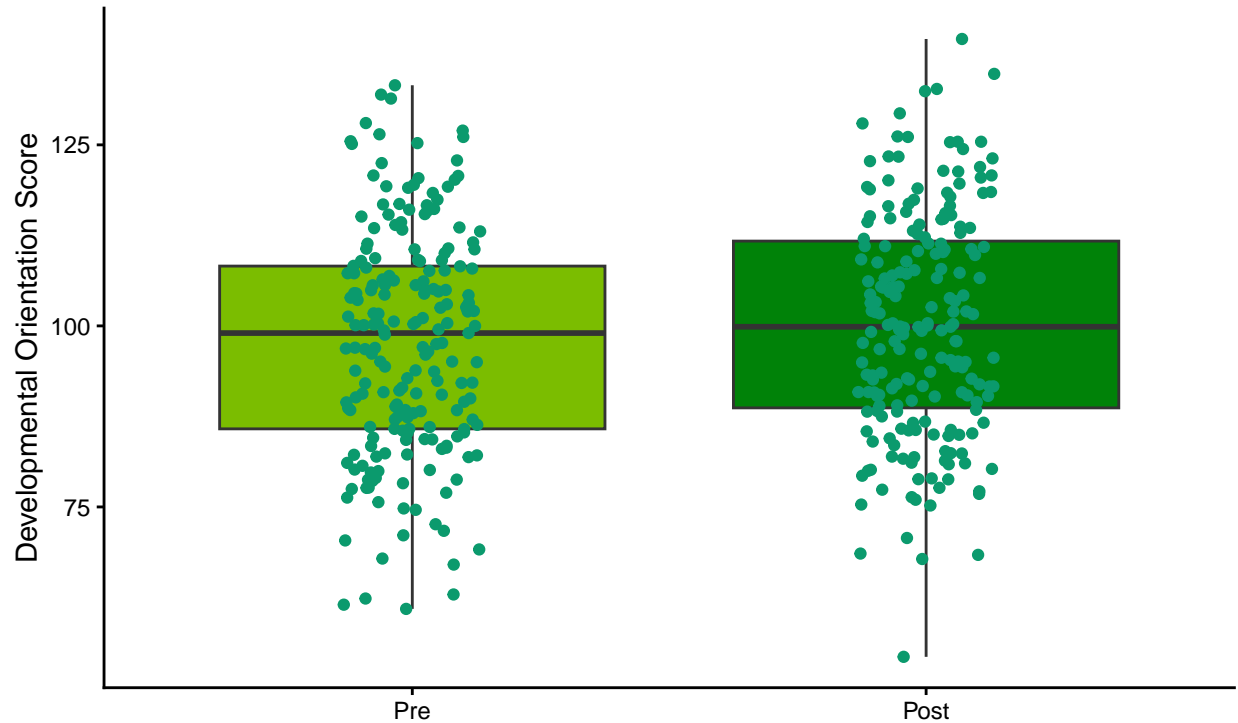
The above distribution of Developmental Orientations shows minimal movements from pre to post in terms of orientations.

```
prepost_graph = ggplot(prepost, aes(x = reorder(group, weight), y = weight, fill = group)) +
  geom_boxplot() +
  scale_fill_manual(values=c("#008208", "#7BBD00"))+
  geom_point(position = position_jitterdodge(), color = "#0B9A6D") +
  labs(title = "Change in IDI Scores",
       subtitle = "2024 internship completers' change in development orientation scores",
       x = "",
       y = "Developmental Orientation Score") +
  theme_MSU() +
  guides(fill = FALSE)
```

```
## Warning: The '<scale>' argument of 'guides()' cannot be 'FALSE'. Use "none" instead as
## of ggplot2 3.3.4.
## This warning is displayed once every 8 hours.
## Call 'lifecycle::last_lifecycle_warnings()' to see where this warning was
## generated.
```

Change in IDI Scores

2024 internship completers' change in development orientation scores



The above graph compares the quantitative DO scores on a boxplot. Post-scores have a larger range of scores. The middle two quadrants are higher on the continuum. Overall, we do see a positive shift in scores.

```
t.test(data$PreDO, data$PostDO, paired=TRUE, alternative="two.sided")
```

```
##
## Paired t-test
##
## data: data$PreDO and data$PostDO
## t = -2.3642, df = 198, p-value = 0.01904
## alternative hypothesis: true mean difference is not equal to 0
## 95 percent confidence interval:
## -4.4639104 -0.4037278
## sample estimates:
## mean difference
## -2.433819
```

Using a paired t test, the difference between the mean Pre-DO and Post-DO is significantly significant. Therefore, we are confident that the student's intercultural competence did progress, likely as a result of their coursework and placement experiences or other experiences in their time at MSU.

One-Year Out

The Michigan Department of Education (MDE) surveys administrators after the first year of teaching. MSU received 75 responses for the first-year teachers who graduated from MSU

Of the 75 first-year teachers evaluated, we have 55 of these completer's pre- and post-IDI scores. Note that 3 responses to the administration survey were "Not able to observe" and were not included in this number.

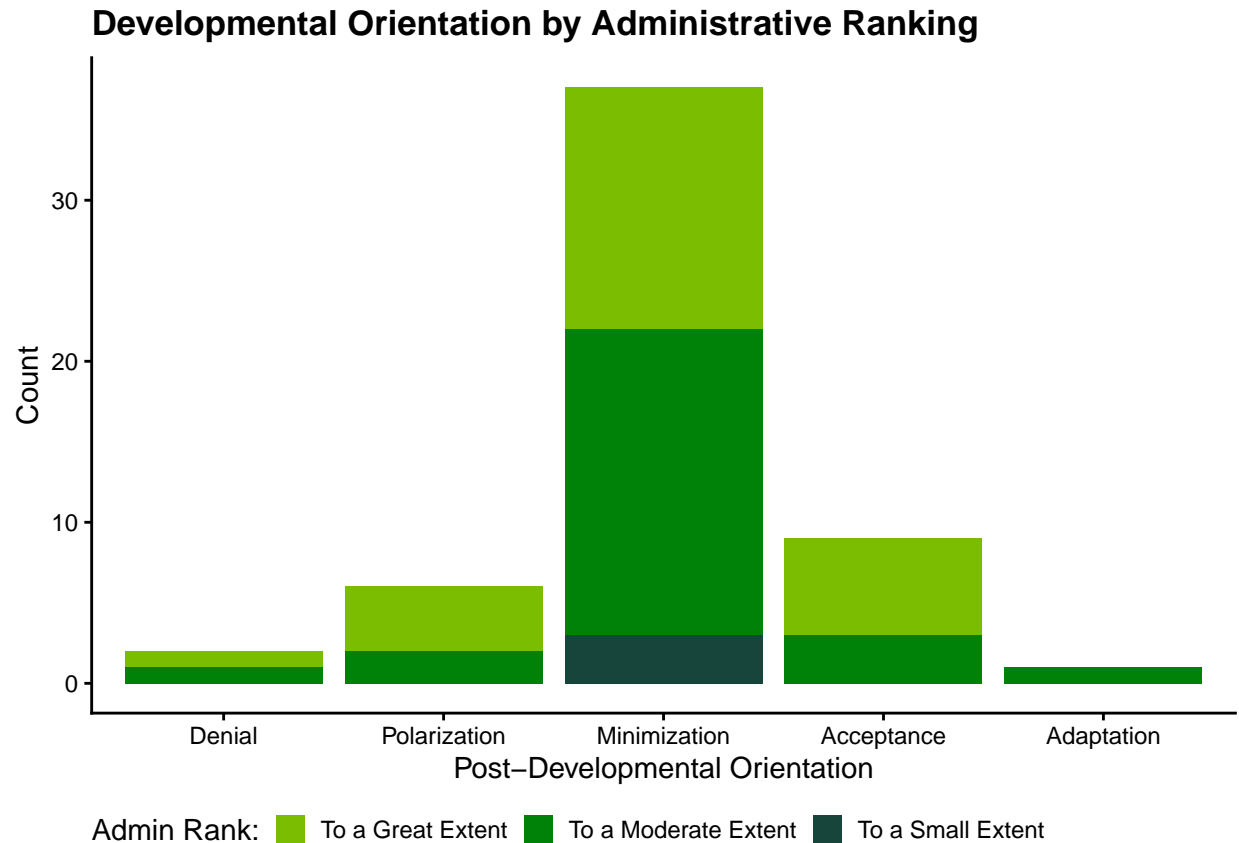
```
#create dataframe with observations that include an administrator survey
admin = data %>% filter(AY01!="N/A")
# nrow(admin)
```

```
admin %>% group_by(AY01) %>% summarise(count = n(),
                                       mean = mean(PostDO),
                                       sd = sd(PostDO))
```

```
## # A tibble: 3 x 4
##   AY01                count mean  sd
##   <chr>              <int> <dbl> <dbl>
## 1 To a Great Extent    26  103. 16.6
## 2 To a Moderate Extent 26  100. 16.0
## 3 To a Small Extent   3   101.  1.11
```

The mean Post-DO score was higher for the first-year teachers that received a "To a Great Extent" ranking in response to the question "As a first-year teacher, compared to other first-year teachers, to what extent can [Teacher Name] apply instructional strategies and resources to support students from culturally diverse backgrounds?"

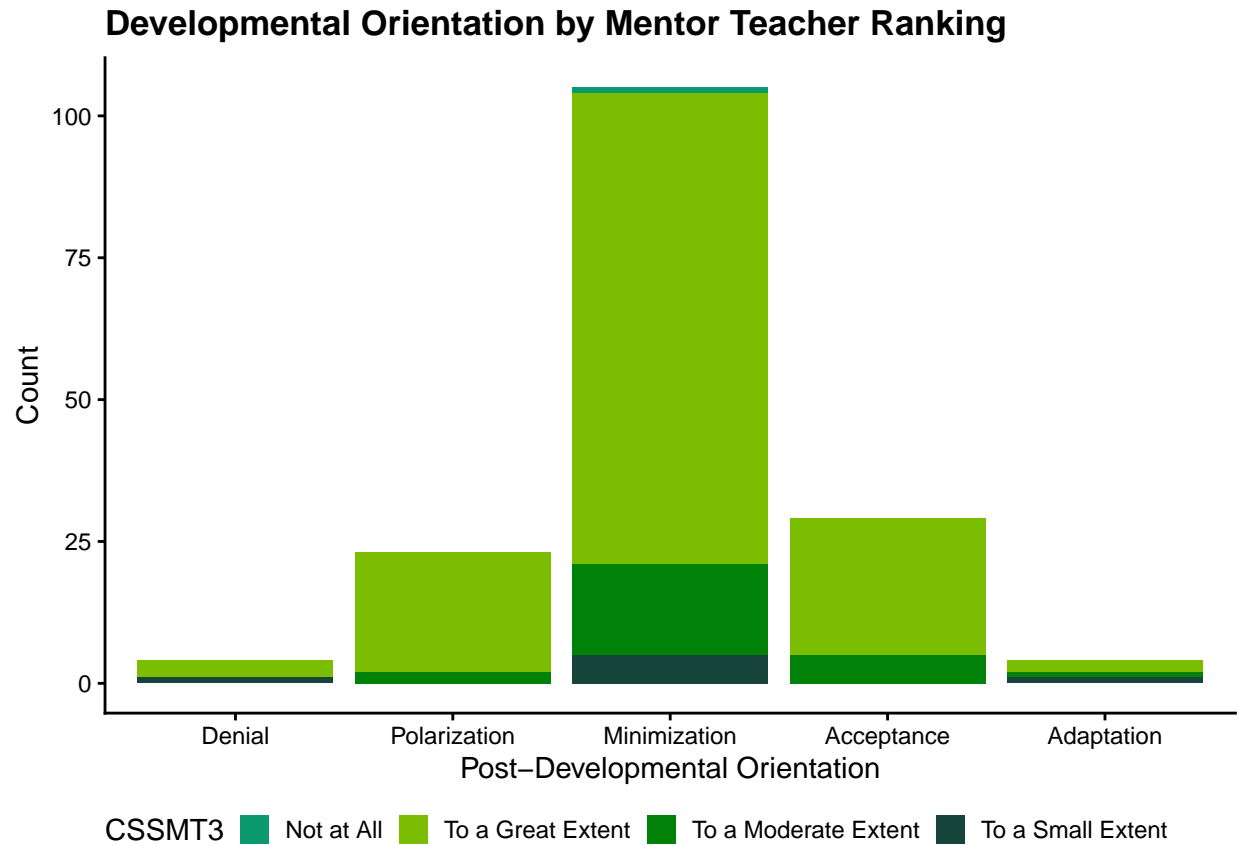
```
ggplot(admin, aes(fill=AY01, x=factor(PostName, orients))) +
  geom_bar() +
  labs(x="Post-Developmental Orientation",
       y="Count",
       title="Developmental Orientation by Administrative Ranking",
       fill="Admin Rank:") +
  scale_fill_manual(values=c("#7BBD00", "#008208", "#18453B", "#0B9A6D", "#008934")) + theme_MSU()
```



Further visualization reveals not much of a relationship between Post-DO scores and administrator's perceptions. It is interesting that the three teachers who received a "To a Small Extent" had developmental orientation scores in the Minimization categories as opposed to Denial or Polarization. Similarly, the teacher that scored in the Adaptation orientation (the furthest along the continuum) received a "Moderate" ranking.

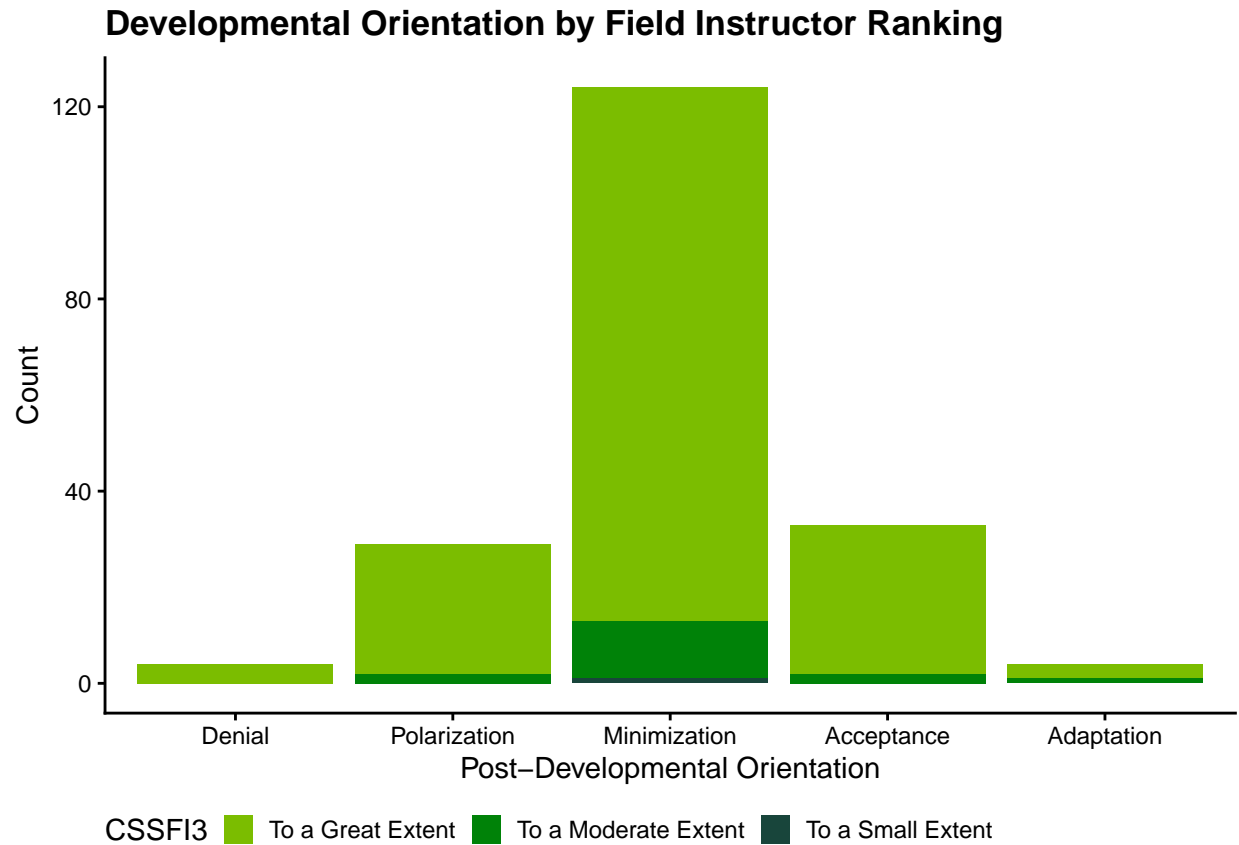
```
# Mentor Teacher's answers to the same question a year earlier
cssmt = data %>% filter(!is.na(CSSMT3))

ggplot(cssmt, aes(fill=CSSMT3, x=factor(PostName, orients))) +
  geom_bar() +
  labs(x="Post-Developmental Orientation",
       y="Count",
       title="Developmental Orientation by Mentor Teacher Ranking") +
  scale_fill_manual(values=c("#0B9A6D", "#7BBD00", "#008208", "#18453B", "#008934")) + theme_MSU()
```



```
# Field Instructors's answers to the same question a year earlier
cssfi = data %>% filter(!is.na(CSSF13))

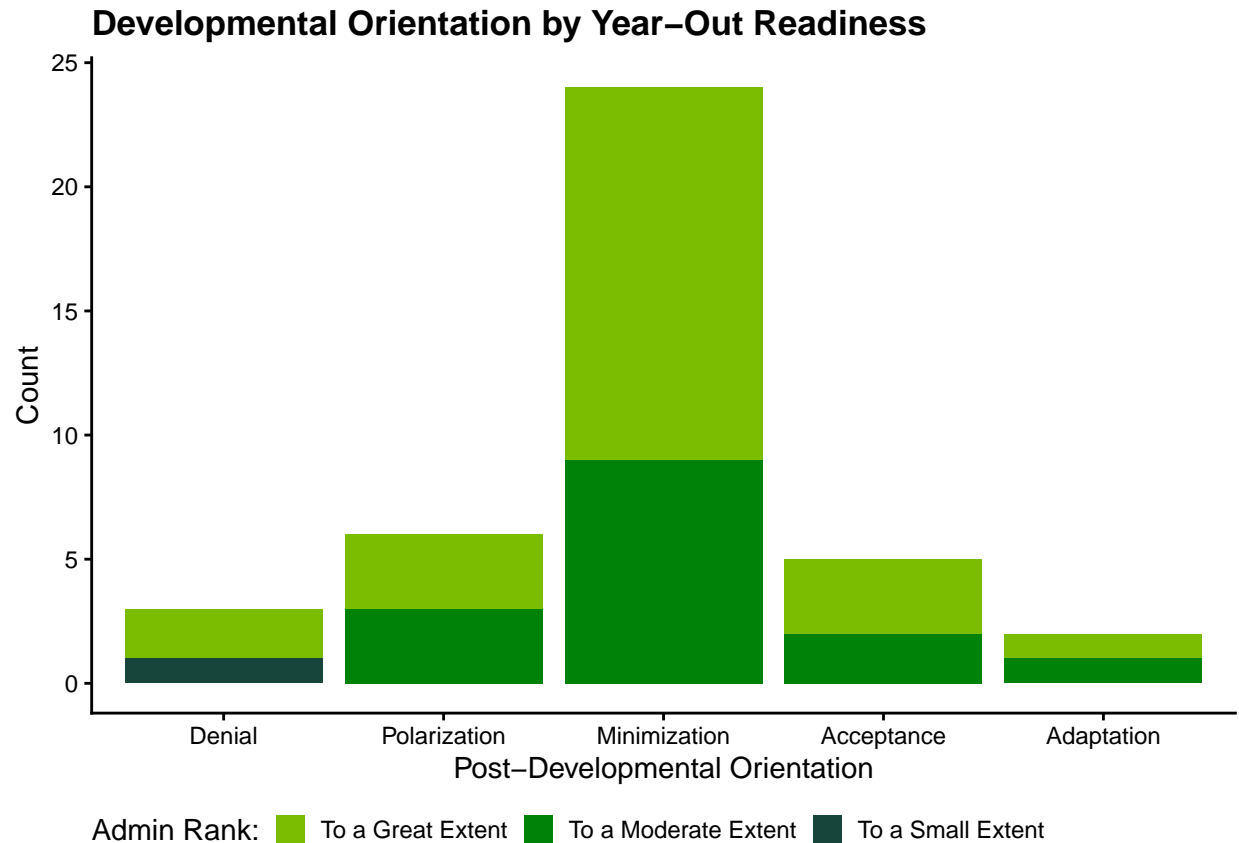
ggplot(cssfi, aes(fill=CSSF13, x=factor(PostName, orients))) +
  geom_bar() +
  labs(x="Post-Developmental Orientation",
       y="Count",
       title="Developmental Orientation by Field Instructor Ranking") +
  scale_fill_manual(values=c("#7BBD00", "#008208", "#18453B", "#0B9A6D", "#008934")) + theme_MSU()
```

Additionally, no significant trends were revealed by a student's MT or FI MDE survey results either.

```
tyo = data %>% filter(!is.na(TY01))

ggplot(tyo, aes(fill=TY01, x=factor(PostName, orients))) +
  geom_bar() +
  labs(x="Post-Developmental Orientation",
       y="Count",
       title="Developmental Orientation by Year-Out Readiness",
       fill="Admin Rank:") +
  scale_fill_manual(values=c("#7BBD00", "#008208", "#18453B", "#0B9A6D", "#008934")) + theme_MSU()
```



The first-year teacher's own self reflection of the same question as revealed little revealing information.

In excel, I converted the categorical rankings (not at all, to a small extent, to a moderate extent, and to a large extent) to quantitative (0-3) across all questions posed to administrators regarding the first-year teachers, not just those related the culture, and found the average. Our hypothesis was that students who score higher on the IDI would be more likely to be more effective teachers.

```
# calculate the correlation between the average administrator response and Post-DO scores
fit = lm(AYOA ~ PostDO, data)
summary(fit)
```

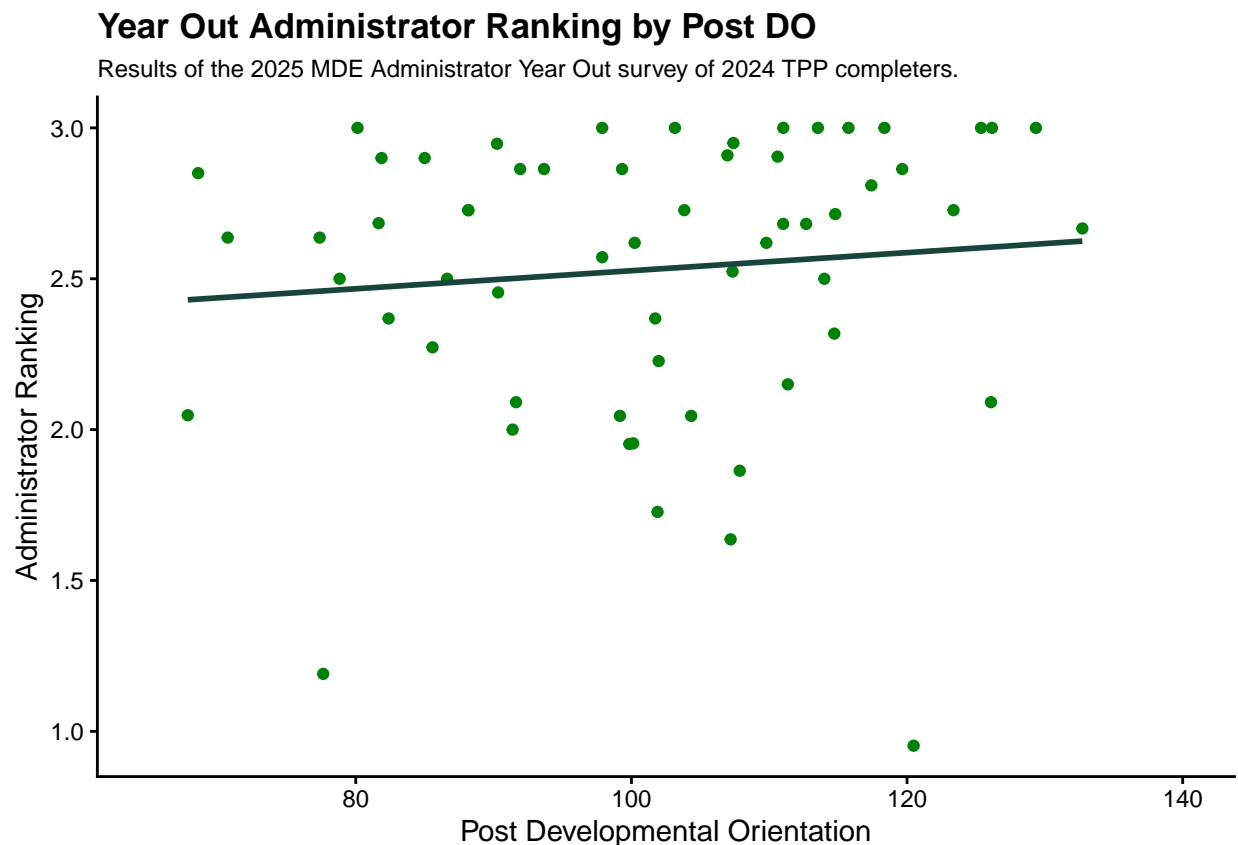
```
##
## Call:
## lm(formula = AYOA ~ PostDO, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.6356 -0.2657  0.1264  0.3675  0.5329
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.227012    0.388880   5.727 3.83e-07 ***
## PostDO       0.002996    0.003794   0.790  0.433
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 0.465 on 58 degrees of freedom
## (139 observations deleted due to missingness)
## Multiple R-squared: 0.01064, Adjusted R-squared: -0.00642
## F-statistic: 0.6237 on 1 and 58 DF, p-value: 0.4329
```

There is no significant correlation between the two. Below, I visualize the data for general trends.

```
# use this information to make a line of best fit
# "#008208", "#18453B"
ggplot(data, aes(x=PostDO, y=AYOA)) +
  geom_point(color="#008208") +
  geom_smooth(method="lm", se=F, color="#18453B") +
  xlim(65,140) +
  labs(title="Year Out Administrator Ranking by Post DO",
        subtitle="Results of the 2025 MDE Administrator Year Out survey of 2024 TPP completers.") +
  xlab("Post Developmental Orientation") +
  ylab("Administrator Ranking") +
  theme_MSU()
```

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



There are limitations to this data. The N is relatively small and the ranking given to first-year students is a subjective interpretation that could vary significantly and potentially inaccurately represent the teacher's ability.

Survey Results

2024 completers were emailed a survey to see how their first year of teaching went, what stuck with them from completing the program, and some background information. We did not have many responses and therefore could not usefully analyze this data.

```
survey = survey %>% rename(Email = MSUEmail) # to use as key to combine
```

```
combined = merge(survey, data, by="Email")
```

```
# find the count of responses  
# none of this was terribly helpful, the N was too low
```

```
# survey %>% group_by(survey$`First Year`) %>% count()  
# survey %>% group_by(survey$`IDI...27`) %>% count()  
# survey %>% group_by(survey$`CA`) %>% count()  
# survey %>% group_by(survey$`Diverse?`) %>% count()  
# survey %>% group_by(survey$Geographic) %>% count()  
# survey %>% group_by(survey$Political) %>% count()
```

```
# Urban v Rural is significant but 1 v 5, and therefore should not be used  
fit = lm(PostD0 ~ Geographic, combined)  
summary(fit)
```

```
##  
## Call:  
## lm(formula = PostD0 ~ Geographic, data = combined)  
##  
## Residuals:  
##      Min       1Q   Median       3Q      Max   
## -31.278 -11.288   0.475   7.254  32.099   
##  
## Coefficients:  
##              Estimate Std. Error t value Pr(>|t|)      
## (Intercept)      85.578      7.328  11.678  1.2e-10 ***  
## GeographicSuburban  10.283      8.284   1.241   0.2282      
## GeographicUrban    46.832     17.951   2.609   0.0164 *      
## ---  
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
##  
## Residual standard error: 16.39 on 21 degrees of freedom  
## (3 observations deleted due to missingness)  
## Multiple R-squared:  0.2476, Adjusted R-squared:  0.1759   
## F-statistic: 3.455 on 2 and 21 DF,  p-value: 0.05046
```

```
# political, not significant  
fit = lm(PostD0 ~ Political, combined)  
summary(fit)
```

```
##  
## Call:  
## lm(formula = PostD0 ~ Political, data = combined)
```

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -32.299  -9.134  -2.092   9.131  32.530
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      106.795      12.650   8.443 7.46e-08 ***
## PoliticalLiberal    -20.196      13.985  -1.444   0.165
## PoliticalModerate  -11.365      14.343  -0.792   0.438
## PoliticalVery Liberal  -2.703      14.967  -0.181   0.859
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 17.89 on 19 degrees of freedom
## (4 observations deleted due to missingness)
## Multiple R-squared:  0.1792, Adjusted R-squared:  0.0496
## F-statistic: 1.383 on 3 and 19 DF,  p-value: 0.2785
```

Responses to the question: “What aspect of your education through the MSU Teacher Preparation Program stuck with you the most?”

```
# comments/qualitative results,
#survey$`What Stuck?`[!is.na(survey$`What Stuck?`)]
```

Responses to the question: “In what ways did the MSU TPP curriculum prepare you or not prepare you for your current profession?”

```
# comments/qualitative results
# survey$`Cirriculum?`[!is.na(survey$`Cirriculum?`)]
```

Responses to the question: “What are your views on the teaching profession?”

```
# same here
# survey$`Views on Teaching?`[!is.na(survey$`Views on Teaching?`)]
```