Individual learner's characteristic

Data processing

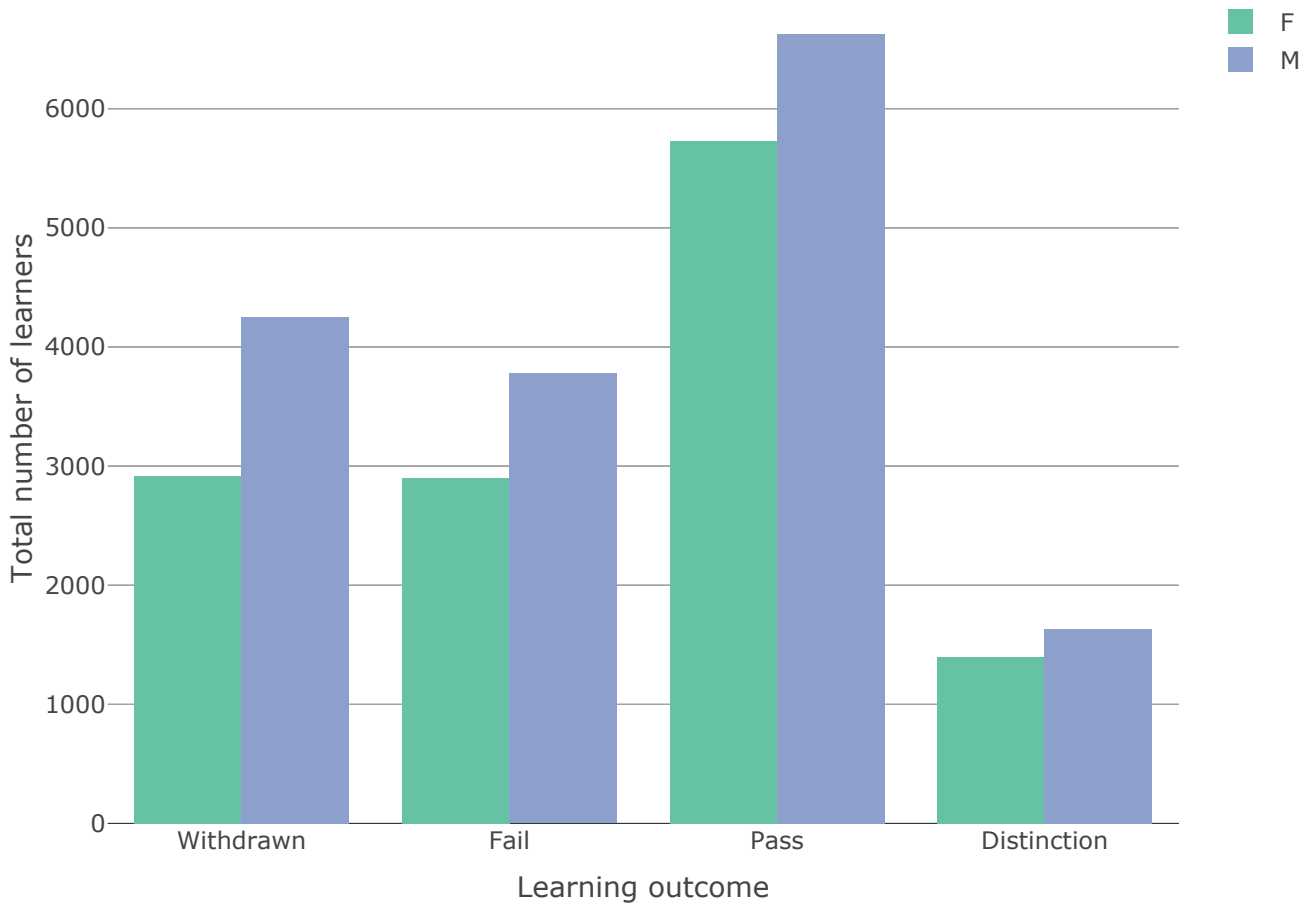
```
library(dplyr)
library(oulad)
library(ggplot2)
data(course)
data(assessment)
data(student)
data(vle)
data(student_assessment)
data(student_vle)
data(student_registration)
student_vle_unique<- student_vle %>% group_by(code_module,code_presentation,id_student,i
d_site,date) %>% summarise(sum_click=sum(sum_click))
rm(student_vle)
#Get student-level info across multiple datasets
tmaRatio<- assessment %>% filter(assessment_type!="Exam") %>% group_by(code_module,code_
presentation) %>% summarise(tma=mean(assessment_type=="TMA"))

moduleStudentClick<-student_vle_unique %>% group_by(code_module,code_presentation,id_stu
dent) %>% summarise(meanDailyClick=sum(sum_click)/n_distinct(date))
mergedData<- merge(student,tmaRatio,by=c("code_module","code_presentation"))
mergedData<- merge(mergedData,moduleStudentClick,by=c("code_module","code_presentation",
"id_student"))

mergedData$code_module_category<-"Social sciences"
mergedData$code_module_category[mergedData$code_module %in% c("CCC","DDD","EEE","FFF")]<
-"STEM"
#re-code final result and education level as ordered factor variables
uniq_levels<-unique(mergedData$highest_education)
mergedData$highest_education<-factor(mergedData$highest_education,levels=uniq_levels[c(5
,2,3,1,4)],ordered=T)
mergedData$final_result<-factor(mergedData$final_result,levels=c("Withdrawn","Fail","Pas
s","Distinction"),ordered = T)
```

Sex vs. final result

Female students tend to do better in social science classes, male students do better in STEM classes.

```
library(plotly)
library(tidyr)
library(dplyr)
figure1 <- plot_ly(mergedData, x = ~final_result, color = ~gender) %>% add_histogram() %
>% layout(title = 'Gender and Learning outcome',xaxis = list(type='category',title='Lear
ning outcome'), yaxis=list (title='Total number of learners'),range = c(0,30000))
figure1
```

Gender and Learning outcome

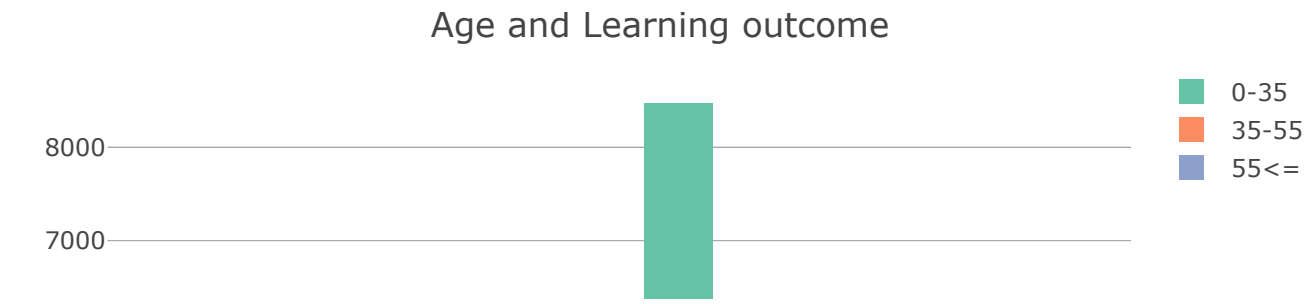


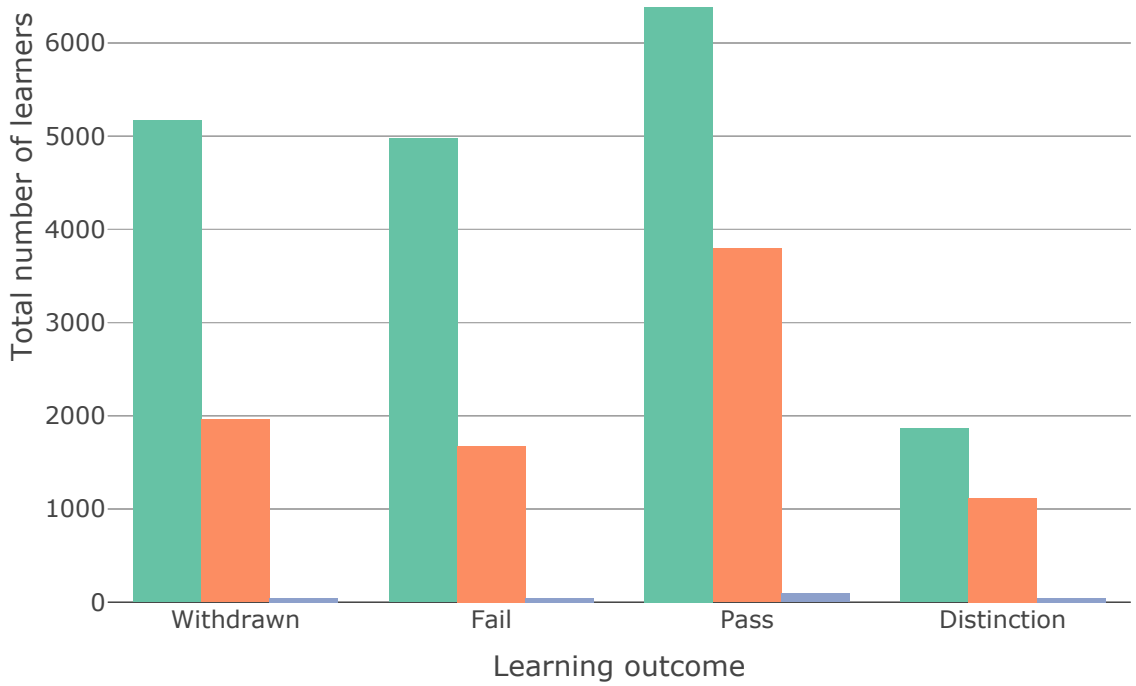
Age vs. final result

Younger students (<35) tend to do better, in both social science and STEM classes.

```
figure2 <- plot_ly(mergedData, x = ~final_result, color = ~age_band) %>% add_histogram()
%>% layout(title = 'Age and Learning outcome',xaxis = list(type='category',title='Learni
ng outcome'), yaxis=list (title='Total number of learners'),range = c(0,30000))
figure2
```

```
## Warning: 'layout' objects don't have these attributes: 'range'
## Valid attributes include:
## 'font', 'title', 'titlefont', 'autosize', 'width', 'height', 'margin', 'paper_bgcolo
r', 'plot_bgcolor', 'separators', 'hidesources', 'showlegend', 'colorway', 'datarevisio
n', 'template', 'dragmode', 'hovermode', 'hoverdistance', 'spikedistance', 'hoverlabel',
'selectdirection', 'grid', 'calendar', 'xaxis', 'yaxis', 'ternary', 'scene', 'geo', 'map
box', 'polar', 'radialaxis', 'angularaxis', 'direction', 'orientation', 'editType', 'leg
end', 'annotations', 'shapes', 'images', 'updatemenus', 'sliders', 'barmode', 'bargap',
'mapType'
```



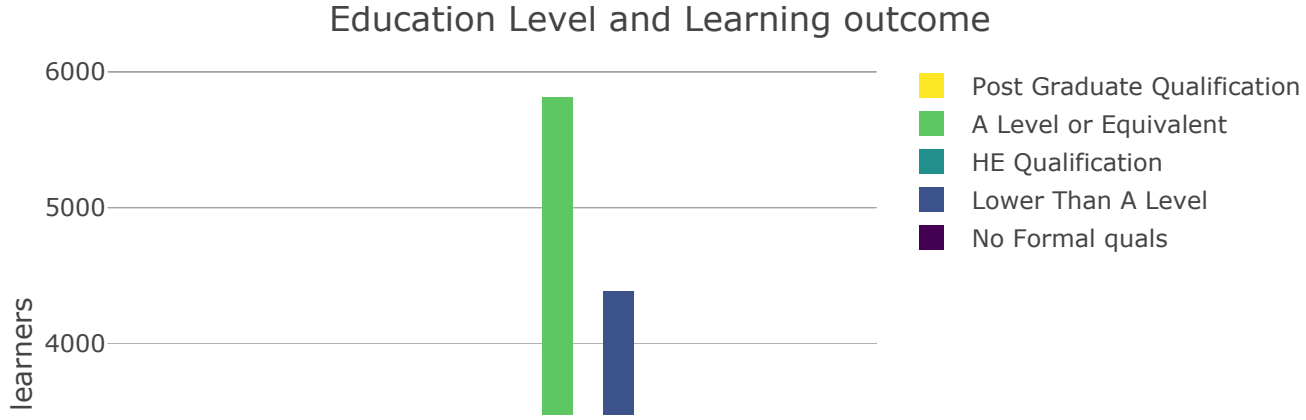


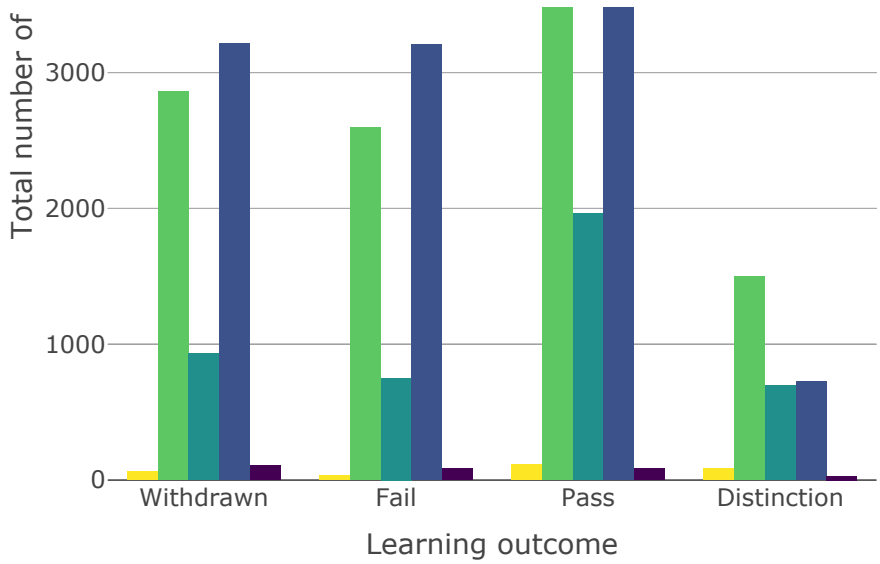
Education level and final result

It seems that better prior education levels are associated with better class outcome, especially STEM class outcome. In heat map, red means we observe more students with a particular combination of education level and final result than expected by chance.

```
figure3 <- plot_ly(mergedData, x = ~final_result, color = ~highest_education) %>% add_hi
stogram() %>% layout(title = 'Education Level and Learning outcome',xaxis = list(type='c
ategory',title='Learning outcome'), yaxis=list (title='Total number of learners'),range
 = c(0,30000))
figure3
```

```
## Warning: 'layout' objects don't have these attributes: 'range'
## Valid attributes include:
## 'font', 'title', 'titlefont', 'autosize', 'width', 'height', 'margin', 'paper_bgcolo
r', 'plot_bgcolor', 'separators', 'hidesources', 'showlegend', 'colorway', 'datarevisio
n', 'template', 'dragmode', 'hovermode', 'hoverdistance', 'spikedistance', 'hoverlabel',
'selectdirection', 'grid', 'calendar', 'xaxis', 'yaxis', 'ternary', 'scene', 'geo', 'map
box', 'polar', 'radialaxis', 'angularaxis', 'direction', 'orientation', 'editType', 'leg
end', 'annotations', 'shapes', 'images', 'updatemenus', 'sliders', 'barmode', 'bargap',
'mapType'
```

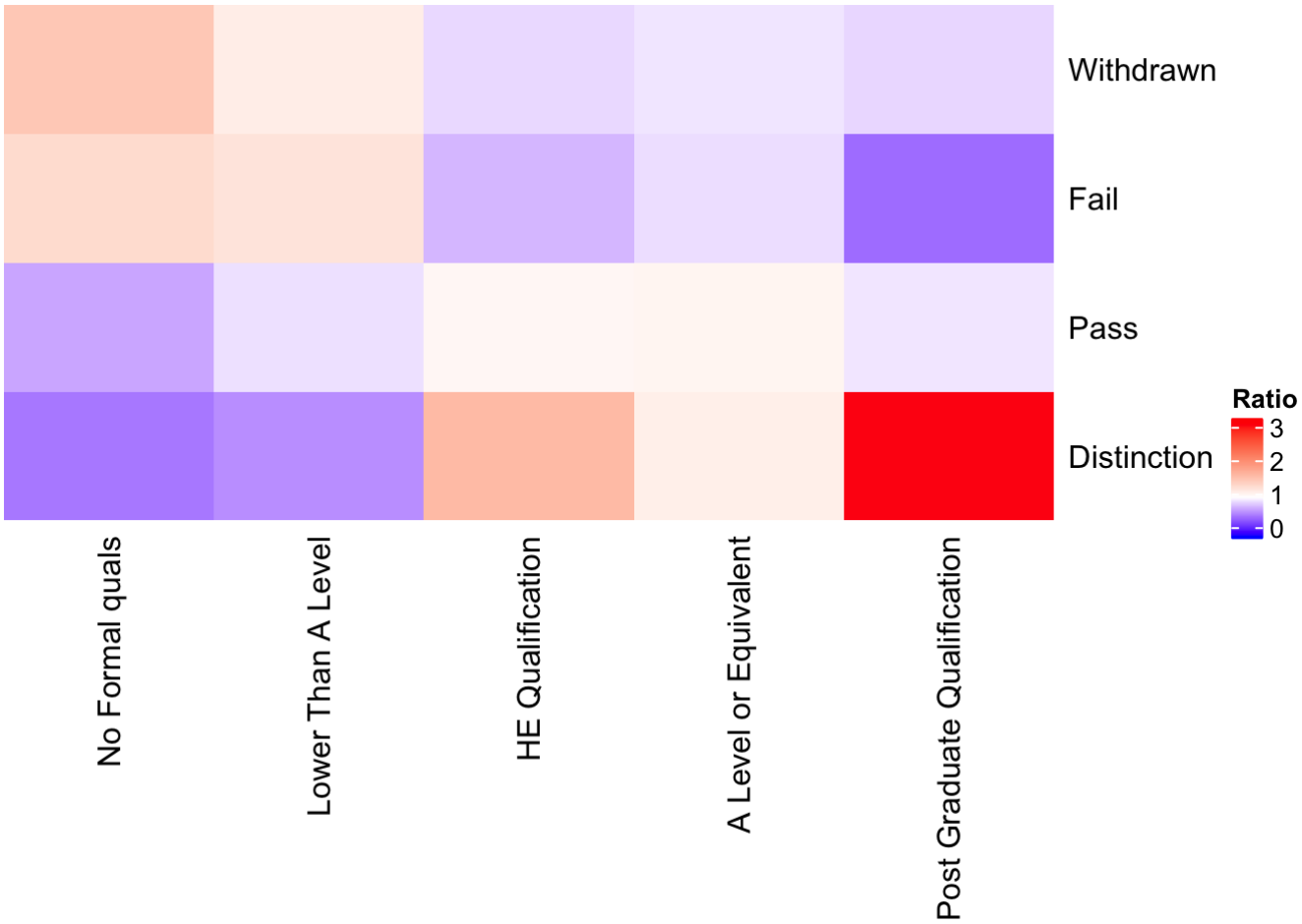





```
chisqResult<-chisq.test(mergedData$final_result,mergedData$highest_education)
chisqResult
```

```
##
##  Pearson's Chi-squared test
##
## data:  mergedData$final_result and mergedData$highest_education
## X-squared = 906.11, df = 12, p-value < 2.2e-16
```

```
ratioMat<-as.data.frame.matrix(chisqResult$observed/chisqResult$expected)
library(ComplexHeatmap)
library(circlize)
Heatmap(ratioMat,name="Ratio",cluster_rows = F,cluster_columns = F,col = colorRamp2(c(0,
 1, 2.9), c("blue", "white", "red")))
```


Withdrawn
Fail
Pass
Distinction
Ratio
3
2
1
0
No Formal quals
Lower Than A Level
HE Qualification
A Level or Equivalent
Post Graduate Qualification