# 2.6 ANCOVA

## Analysis of covariance (ANCOVA)

The **analysis of covariance** is the term used for models in which *some of the explanatory variables are dummy variables* representing factor levels and *others are continuous measurements* called covariates.

We compare means of subgroups defined by factor levels, but we consider that the covariates may also affect the responses, therefore *we compare the means after adjustment for covariate effects*.

# Example: Training methods

- The *responses* $Y_{jk}$ are achievement scores measured at *three levels of a factor*
- The factor represents three different training methods
- The *covariates* $X_{jk}$ are **aptitude scores** measured before training commenced

We want to *compare the training methods,* taking into account differences in initial aptitude between the three groups of subjects.

```
library(ggplot2) #Install if needed
library(dobson)

data("achievement")
attach(achievement)
plot(achievement)

ggplot(achievement, aes(x = x, y = y, colour = method)) +
  geom_point(aes(shape=method, color=method)) +
  labs(x = "Initial aptitude, x") +
  labs(y = "Achievement score, y")
```
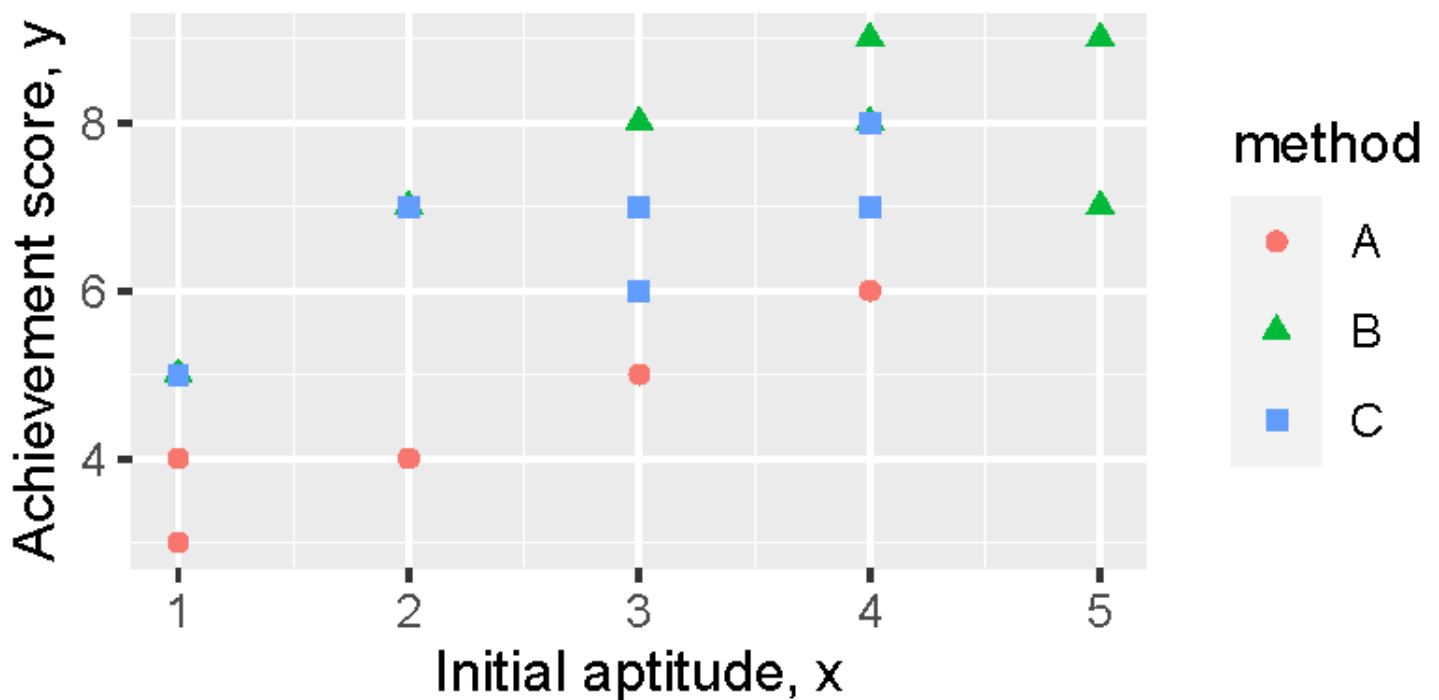


```
library(dobson)

data("achievement")
attach(achievement)

res.lm <- lm(y ~ method + x, data = achievement)
summary(res.lm)
```

**Note:** To get directly the results of the $F$-test we can use the `lm` function.

```
res.glm <- glm(y ~ method + x, data = achievement)
summary(res.glm)
```

```
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data("achievement")
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summary(res.glm)
```