14 Explanation Model

A research team sought to estimate the model $E(Y) = \beta_0 + \beta_1 x + \beta_2 w$. The variable Y was the measure of the task proficiency of an employee observed 6 years after training; the variable w was the employee's education level observed 2 years after training; and the variable x was the measure of the task proficiency of an employee observed immediately after training. They observed values of y, x, w on $n = 534$ employees. They found that the standard deviation of Y, where the variance estimator used division by $n - 1$, was 54.9; the standard deviation of x was 45.2; and the standard deviation of w was 53.6. The correlation between Y and w was 0.41; the correlation between Y and x was 0.81; and the correlation between x and w was 0.51. Total 110 points

1. Compute the partial correlation coefficient $r_{Yx \cdot w}$. (15 points).
2. Compute the partial correlation coefficient $r_{Yw \cdot x}$. (15 points).
3. Which of the following is the best causal model for this data? (20 points)
   a. Explanation model.
   b. Mediation model.
   c. Neither a nor b.

1. $$r_{yx \cdot w} = \frac{r_{yx} - r_{yw} r_{xw}}{\sqrt{(1 - r_{yw}^2)(1 - r_{xw}^2)}}$$

$$= \frac{0.81 - (0.41)(0.51)}{\sqrt{(1 - (.41)^2)(1 - (.51)^2)}}$$

$$= \frac{0.81 - 0.2091}{\sqrt{(1 - 0.1681)(1 - 0.2601)}}$$

$$= \frac{0.6009}{\sqrt{(0.8319)(0.7399)}} = \frac{0.6009}{\sqrt{0.61552}}$$

$$= \frac{0.6009}{0.78455} = \boxed{0.76591.}$$

2. $$r_{yw \cdot x} = \frac{r_{yw} - r_{yx} r_{wx}}{\sqrt{(1 - r_{yx}^2)(1 - r_{wx}^2)}}$$

$$= \frac{0.41 - (0.81)(0.51)}{\sqrt{(1 - (0.81)^2)(1 - (0.5^2)}}$$

$$= \frac{0.41 - 0.4131}{\sqrt{(1 - 0.6561)(1 - 0.2601)}}$$

$$= \frac{-0.0031}{\sqrt{(0.3439)(0.7399)}} = \frac{-0.0031}{\sqrt{0.25445}}$$

$$= \frac{-0.0031}{0.50443} = \boxed{-0.00615.}$$

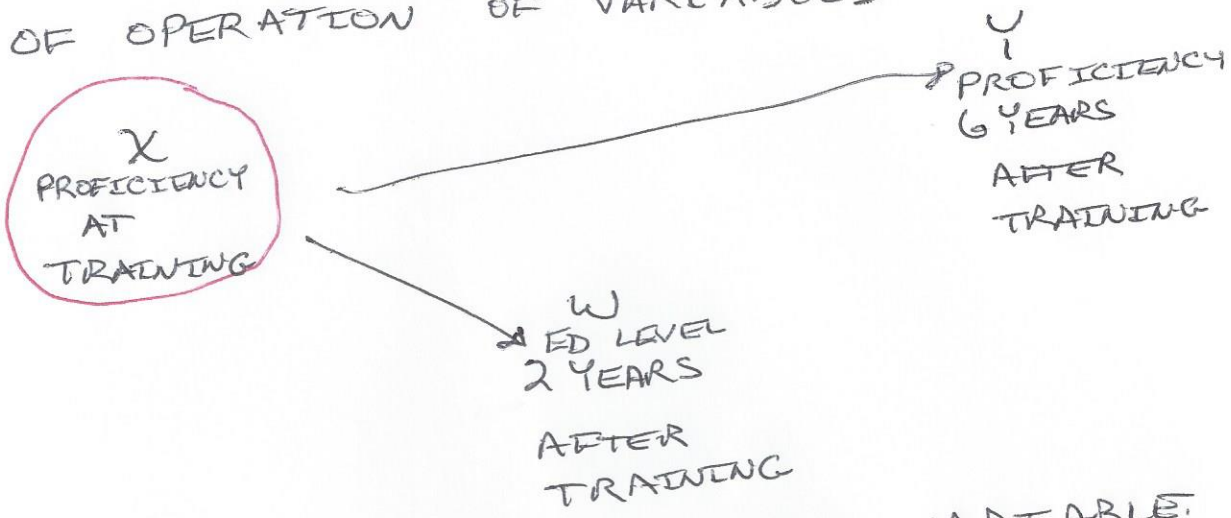
3. RECALL STANDARD ERROR OF $r_{yw \cdot x}$

$$\cong \frac{1}{\sqrt{n-3}} = \frac{1}{\sqrt{534-3}} = \frac{1}{\sqrt{531}} = 0.043$$

SINCE $r_{yw \cdot x}$ IS CLOSE TO 0

X IS THE KEY VARIABLE.

NOW LOOK AT TIME ORDER OF OPERATION OF VARIABLES



IDENTIFY KEY VARIABLE.

SINCE KEY VARIABLE OPERATES FIRST,

THIS IS AN EXPLANATION MODEL.

THE VARIABLE W (ED LEVEL 2 YEARS AFTER TRAINING) DOES NOT HAVE ANY ASSOCIATION WITH PROFICIENCY 6 YEARS AFTER TRAINING WHEN PROFICIENCY AFTER TRAINING IS CONTROLLED.