



## **Missing Value Effect on the Estimation of Item Response Theory Parameters: A Simulation Study by Increasing the Item Difficulty Level**

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### **Abstract**

Missing values are frequently found in real data sets. In some instrument designs, for example, in measuring academic achievement, the item difficulty level increases. Therefore, it is common to get unfilled items at the end of the test. The main purpose of this paper is to explore the effect of missing values percentages (10, 20 and 30%) in parameter estimation for a two parameter logistic Item Response Theory model, when the difficulty in the test is ascendant (from -2 to 2) and the discrimination parameter is set randomly. Moreover, we seek to determine the best way to treat those missing values using two imputation methods: treat them as incorrect answers and by mean substitution. Through a simulation study (n=1000, 45 items and 100 replications), we found that in both imputation methods, the difficulty parameter increases as the percentage of missingness increases. The pattern is not clear enough in the discrimination parameter for both imputation methods. Furthermore, if there are 20% of unfilled items, the best way to treat them is by mean substitution (due to a lower Root Mean Square Error and a lower bias); but, if this value increases to 30%, replacement by zero seems to be the best option.

**Keywords:** Root Mean Square Error; bias; discrimination parameter.