



Examining response aberrance as a cause of outliers in statistical analysis



Wahyu Widhiarso^{a,*}, Bambang Sumintono^b

^a Faculty of Psychology, Universitas Gadjah Mada, Yogyakarta, Indonesia

^b Institute of Educational Leadership, University of Malaya, Malaysia

ARTICLE INFO

Article history:

Received 8 January 2016

Received in revised form 30 March 2016

Accepted 30 March 2016

Available online xxxx

Keywords:

Aberrant response

Person-fit statistic

Outliers

Rasch model

ABSTRACT

This study examined to what extent participants who produce aberrant responses were in fact outliers in statistical analysis. Participants of this study were high school students ($N = 2983$) who filled out three personality questionnaires. Response aberrance for these instruments was detected using infit, outfit, and person-fit statistics under Rasch modeling, all of which reflect the degree to which response patterns conform to the model. According to the person-fit cutoff, participants were divided into three categories: overfit, fit, and underfit. Mahalanobis Distance (MD) was used to identify participants classified as outliers, based on a simple regression analysis. Analysis of variance highlighted significant differences between these three categories. The study found that underfit persons were more likely exhibited higher MD values than overfit or fit persons, meaning that they tended to perform as outliers. The correlation coefficients between two variables considerably increased after underfit persons were excluded in subsequent analyses. Another result showed that participants tended to consistently produce aberrant responses across the questionnaires, but that they did not consistently perform as outliers.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

The statistical analysis using a least squares method is still a very useful tool in analyzing data. One of the techniques employed in this method is correlation and a linear regression analysis that models the relationship between response and explanatory variable(s). However, the statistical estimates obtained by those techniques can be unreliable, under- or overestimated, and less informative when there are too many outliers that distort the true relationships between variables. The occurrence of outliers in the data can markedly distort the relationship among the variables investigated; they can cause problems in analysis interpretation. The problem of outliers in statistical analysis then still remains an important issue to be investigated. Most statistical analyses used in personality assessment and in the behavioral sciences in general rely on statistics based on score averages, which can be sensitive to outliers (Tetlock & Mitchell, 2009).

Previous studies investigating outliers have been more focused on identifying outliers in the data (e.g., Leys, Ley, Klein, Bernard, & Licata, 2013; Wang & Serfling, 2015) than in exploring the factors that cause outliers. Exploring these factors would help researchers to decide whether outliers should be removed and to determine when outliers accurately reflect the phenomenon of interest. Knowing these factors enables researchers to more accurately identify what individual characteristics are most likely to be associated with outliers in statistical analysis. By identifying these factors, researchers can reduce the

number of participants that are erroneously excluded from analyses because they are classified as outliers.

The occurrence of outliers is frequently unavoidable when a survey is carried out using questionnaires, especially when data are being collected for multiple purposes (Lee, 2008). Outliers are defined as highly unusual or improbable values of a variable, as compared to the distribution of all valid values (Bethlehem, 2009). Outliers can arise from data errors or inherent variability (Anscombe, 1960), and while some studies found outliers may indeed be invalid, other may represent valid but simply extreme responses. Factors that have been identified as potentially affecting the presence of outliers include the desire to make a positive impression, social desirability, over-reporting, a desire to sabotage the research (Evans, 1999; Osborne & Overbay, 2004), carelessness, intentional silliness (Dörnyei & Taguchi, 2009), and random or extreme responding (Zijlstra, van der Ark, & Sijtsma, 2011). One core characteristic of outliers is that they represent any variables whose values are not in line with the statistical model being employed. This is similar to aberrant responding, which is defined as any responses that do not fit the measurement model used.

The correlation between two scores of instruments that measure similar construct becomes lower when participants give aberrant responses. This is because the aberrant responses increase the amount of measurement error and obscure any true relationships among the variables. Schmitt, Chan, Sacco, McFarland, and Jennings (1999) found that aberrant responses as indicated by person fit statistic can have a substantial practical impact on the validity of tests for subgroups identified by level of fit. Another studies also support this finding although they have used different terms to refer to aberrant responses, such as extreme response style (van Herk, Poortinga, & Verhallen, 2004),

* Corresponding author at: Jl. Humaniora No. 1 Yogyakarta, Indonesia.
E-mail address: wahyu_psy@ugm.ac.id (W. Widhiarso).