Getting something out of nothing: Analyzing patterns of null responses to improve data collection methods in sub-Saharan Africa

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ABSTRACT

Careful development and adaptation of assessments are imperative for cultural psychological research. However, despite the best efforts, the use of assessments in new contexts can reveal atypical and/or unexpected patterns of performance. We found this to be the case in the testing of assessments to be used for a larger investigation of Specific Reading Disabilities in Zambia. In a sample of 207 children (100 female) from grades 2 to 7, we illustrated that assessment characteristics (i.e., stimulus type, answer choice, and response type) differentially impact patterns of responsiveness. The number of missing values was the highest for assessments that (1) used written stimuli, (2) had an open-ended answer choice, and (3) required an action response. Age and socio-economic status explained some of the variance in responsiveness in selected, but not all assessments. Consideration of the impact of stimulus and response types when adapting assessments cross-linguistically and cross-culturally is essential.

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1. Introduction

Worldwide, assessments for research in less extensively studied countries, cultures, and languages are not readily available. Therefore, research in a country such as Zambia, the location of the research project presented here, is often faced with the challenge of developing and adapting assessments required for the particular purpose of the study. The adaptation of reliable, linguistically valid and bias-free assessments is a major task for cultural psychology (Peña, 2007; Van de Vijver & Hambleton, 1996). Cross-cultural literature has emphasized the importance of establishing linguistic, cultural, functional, and metric equivalence for assessments in new contexts (Hambleton & Kanjee, 1995; Peña, 2007). Even if these expectations are met, empirical examination of whether the utilized assessment procedures are adequate for new applications is necessary (Van de Vijver & Hambleton, 1996). Adequate test and assessment development is a growing concern worldwide (International Test Commission, 2006); however, even when assessments are linguistically appropriate and were properly adapted for the specific context in which they are used, data collection can reveal challenges. In this brief report, we aim to illustrate the relation between null responses on a variety of reading-related assessments and characteristics pertaining to the assessment and the examinee.

Three major factors have been suggested as sources for biases in inferring examinees' performance on assessments: construct, method, and item (e.g., van de Vijver & Poortinga, 1997, 2005). First, the construct being assessed may have a different definition and notion across cultures, with potential differential appropriateness of item and stimulus content. Second, the assessment method could induce response biases, which could be due to the assessment itself (e.g., children's lack of familiarity with the response procedures and the stimuli, complex instructions) or to its administration (e.g., assessment conditions and assessor effects). Third, features of items such as poor wording or inadequate coverage of the curriculum can lead to bias in the assessment. Here, we report on an observation made during the pilot phase of a study in Zambia. Despite culturally specific efforts to carefully design and comprehensively adapt, when needed, the study's main phase assessments, the participants sometimes failed to respond to assessment stimuli. To reduce potential sources of method bias, the development and piloting stages of these assessments for use in another region in Zambia (Stemler et al., 2009) focused on ensuring a high level of stimulus familiarity. Items and assessment procedures were developed to reflect students' low levels of acquaintance with standardized testing and lack of previous test exposure. To increase fairness to examinees, the tasks were designed to be ecologically valid, that is, as similar as possible to the type of tasks that children have to solve in

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school and everyday life. Still, the otherwise social and friendly students, who were eager to meet visitors and extremely curious about the study's activities, became quiet in response to certain stimuli; and the frequency of such quietness was rather alarming.

Zambia-specific efforts have considered the cultural differences impacting assessment design and educational programs, such as the Panga Munthu Test, developed by Robert Serpell and colleagues, in order to avoid biases caused by lack of experience with pencil and paper tests by using a task in which children are instructed to build a man out of clay (Kathuria & Serpell, 1998). Previous reports on assessment development have included similar contexts, namely low-and-middle income countries of sub-Saharan Africa (e.g., Foxcroft, 2011; Grigorenko, 2009; Holding et al., 2004; Tan, Reich, Hart, Thuma, & Grigorenko, 2014), but the unexpected patterns of null responses were not reported. Other researchers have acknowledged that cultural differences (e.g., students' shyness) might lead to a failure to respond to certain assessments (Baddeley, Gardner, & Grantham-McGregor, 1995), but no more specifics were offered. In fact, there is little discussion of the issues on unresponsiveness in cross-cultural literature.

Therefore, we argue that it is important to review missing response patterns and their relation to assessment characteristics (e.g., choice type, stimuli type) as well as relevant cultural differences (e.g., amount of in-class student participation) that could result in unresponsiveness. This report reviews the results of a study in preparation of the Bala Bbala Project (BBP—*Bala Bbala* means 'read the word' in Chitonga, a study of Specific Reading Disabilities, SRD, in rural Southern Province, Zambia) designed to evaluate the main study's assessments being used in a new community. After the data were collected, we noticed specific non-random patterns of null responses in the data and therefore engaged in post-hoc analyses to analyze potential factors that might contribute to these patterns. Thus, this report aims to address two questions: (1) How do assessment characteristics (i.e., stimulus type, answer choice, and response type) influence response rates?; and (2) Do age, gender, and socioeconomic status (SES) predict response patterns in the set of items defining the stop rule (i.e., the first 10 items of an assessment)?

2. Method

2.1. Participants

The participants were 207 students (100 female), grades 2–7, from three primary schools, with a mean age of 12.12 years ($SD = 2.14$ years) who participated in the pilot phase of the BBP (Hein, Reich, Thuma, & Grigorenko, 2014; Tan et al., 2014). The large age range among students in primary schools (7.69 to 17.17 years, mode = 7.86, median = 12.00) is typical of rural Zambia. The reason for this wide age distribution is that in rural Zambia in particular and in sub-Saharan Africa in general, children often take breaks from their studies or repeat grades due to financial difficulties, household responsibilities, health problems, or distance to schools (Mumba, 2002). Despite that, the age-grade correlation was relatively high (Spearman's $\rho = .83$, $p < .001$).

2.2. Materials

The assessments are a subset of those in the BBP (see Table 1). The following domains were assessed: phonological memory (PM), phonological awareness (PA), expressive vocabulary (EV), mathematics (Zambian Achievement Test-Mathematics, ZAT-M), pseudoword decoding (ZAT-PW), reading comprehension (ZAT-RC), and reading recognition (ZAT-RR). They represent a range of assessment types and their data are coded in a way that is informative to this discussion of missing data. Most of the assessments were used in previous studies in sub-Saharan Africa. EV was adapted from a similar study in Ghana (Grigorenko et al., 2009) and ZAT was adapted from a previous Zambian study in which Zambian curriculum and the University of Zambia were consulted in the development of assessment materials (Stemler et al., 2009). All of the assessments went through a comprehensive adaption process in which items were translated and back-translated by separate native speakers. Items were discussed with the translators, who were from the local community, with regard to their suitability and relevance. As EV and ZAT were used in similar communities in previous research, adaptations were able to make use of both English and local language versions. PA was developed specifically for use in this community by the translators and linguists with knowledge of the Chitonga phonemic inventory, phonological characteristics, and word formation processes. Since a substantial number of students did not respond to a particular assessment (or at least had a significant amount of missing values), the internal consistencies (Cronbach's α) of the measures used could only be calculated for a smaller number of students (based on a listwise deletion procedure). Most of the internal consistencies were adequate and ranged from .613 for expressive vocabulary to .936 for ZAT-PW. For phonological memory, only 2 students responded to all of the items, which is why Cronbach's α could not be estimated accurately. This observation was one of the reasons that prompted our investigation of missing values in the present study.

Table 1
Description and descriptive statistics of assessments.

Assessment	# items	Stimuli	Choice	Response	Non-responders (%)	All responders	Mixed	$M_{\text{Number missing values}}$
PA-BSyb	10	Verbal	Open	Verbal	62 (30.0)	76	66	4.59
PA-BSeg	10	Verbal	Open	Verbal	41 (19.8)	153	12	2.19
PA-El	10	Verbal	Open	Verbal	52 (25.1)	107	45	3.55
PA-SSyl	10	Verbal	Open	Verbal	64 (30.9)	97	43	4.24
PA-SSeg	11	Verbal	Open	Verbal	43 (20.8)	144	17	2.46
PA-ISM	10	Verbal	Closed	Verbal	37 (17.9)	162	3	1.81
PA-FSM	10	Verbal	Closed	Verbal	40 (19.3)	149	17	2.23
PM	20	Verbal	Open	Verbal	11 (5.3)	177	19	0.70
EV	40	Visual	Open	Verbal	17 (8.2)	108	82	1.46
ZAT-RC-A	18	Writ/vis	Closed	Point/verb	95 (45.9)	83	29	5.33
ZAT-RC-B	10	Written	Open	Action	47 (22.7)	50	39	3.19
ZAT-PW	40	Writ/vis	Open	Verbal	89 (43.0)	79	34	5.20
ZAT-RR	40	Written	Closed	Point/verb	7 (3.4)	199	1	0.25
ZAT-M	60	Written	Closed	Verbal	7 (3.4)	187	13	0.37

Notes. PA = phonological awareness. BSyb = blending syllables. BSeg = blending single segments. El = elision. SSyl = segmenting syllables. SSeg = segmenting single segments. ISM = initial sound matching. FSM = final sound matching. PM = phonological memory. EV = expressive vocabulary. ZAT = Zambian Achievement Test. RC = reading comprehension. PW = pseudoword reading. M = mathematics. RR = reading recognition. Types of stimuli were coded as 1 (*Verbal*), 2 (*Written*), 3 (*Written and Visual*), and 4 (*Visual*). Answer choices were coded as 1 (*Closed answer*) and 2 (*Open answer*). Types of responses were coded as 1 (*Verbal*), 2 (*Pointing or verbal*), and 3 (*Action*). ZAT-RC uses two different assessment modalities. Items 1 to 18 use written and visual stimuli, require closed answers using either a pointing or verbal response. Items 19 to 28 use written stimuli only and allow open responses using an action response. Due to the stop rule, items 19 to 28 were not administered to some of the students.