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Examining Specific Effects of Context on Adaptive Behavior and Achievement in Rural Africa: Six Case Studies from Southern Province, Zambia

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Abstract

Generally accepted as universal, the construct of adaptive behavior differs in its manifestations across different cultures and settings. The Vineland-II was translated into Chitonga and adapted to the setting of rural Southern Province, Zambia. This version was administered to the parents/caregivers of 114 children (grades 3-7, mean age = 12.94, sd = 2.34). The relationships between these children's adaptive behavior, academic achievement and cognitive ability indicators are compared to those usually observed in US samples. Results reflect no association between adaptive behavior and cognitive ability indicators, but a strong relationship between high adaptive behavior and reading-related measures. Six case studies of children with high and low scores on the Vineland-II are presented to illustrate the possible factors affecting these outcomes.

Keywords

Adaptive behavior; Reading; Zambia

Adaptive behavior is the performance of an individual in daily activities pertaining to personal and social functioning. An important aspect essential to its definition and assessment is that it is age related, in most individuals increasing and becoming more complex as they get older. The assessment of adaptive behavior encompasses tasks carried out routinely by an individual in various domains of daily functioning, such as

communication, daily living skills, social interaction, and motor skills (Sparrow et al. 2005). As a construct, adaptive behavior has its roots in the definition of mental retardation (now referred to as intellectual disability, ID; Robinson and Robinson 1976; Sheerenberger 1983; Sparrow et al. 2005). However, it was not formally recognized and used, as an addition to IQ, as a necessary aspect of identifying and classifying mental retardation until after 1951, when the American Association of Mental Retardation (AAMR) published its first official manual, which included deficits in adaptive behavior along with below average intelligence (or cognitive ability) as part of the definition of mental retardation (Heber 1961). Over the years, the measurement of adaptive behavior has proven useful in the evaluation of individual self-sufficiency and social functioning with respect to a wide range of conditions: developmental disorders, such as autism (for a review, see Kraijer 2000) and Down syndrome (Cullen et al. 1981; Dykens et al. 1994), emotional disorders (e.g., Sparrow and Cicchetti 1985, 1987), attentional disorders, such as ADD/ADHD (Roizen et al. 1994; Stein et al. 1995), low birth weight (e.g., Rosenbaum et al. 1995; Taylor et al. 2006), as well as various aspects of academic achievement, including learning disabilities (e.g., Hall and Segarra 2007; Shevell et al. 2005; Webster et al. 2004) and giftedness (Douthitt 1992). Several measures have been developed to assess adaptive behavior [see (Evans and Bradley-Johnson 1988) for an early review of six measures published in close succession in the 1980's]. Over the years, the Vineland-II has come to be recognized as among the most valid and reliable of these (Evans and Bradley-Johnson 1988), and as having excellent psychometric properties and practical utility (Kamphaus 1987).

Because the defining aspects of adaptive behavior include self-sufficiency within one's physical environment and social behavior guided by societal expectation (Sparrow et al. 2005), the specific developmental milestones that guide the measurement of adaptive behavior are culture-specific. To date, the Vineland Adaptive Behavior Scales (in both its original and second edition form) have been translated and adapted internationally (for examples from the Netherlands, France, South Africa, Vietnam, and Greece, see de Bildt et al. 2005; Fombonne and Achard 1993; Geldenhuys 2001; Goldberg et al. 2009; Siaperas and Beadle-Brown 2006, respectively). Valid translations take into account culture-specific milestones of adaptive behavior and provide culturally appropriate examples.

In the current study, working with a rural population in Southern Province, Zambia, we used a translation of the Vineland-II into Chitonga, a Bantu language spoken by more than one million people in Zambia and Zimbabwe (Johnstone and Mandryk 2001), to gather information on children participating in a larger study on the prevalence and etiology of specific reading disabilities. The Vineland was administered to the parents or caregivers of children who had been selected based on their scores on two reading-related tests: phonological awareness and letter knowledge. For this smaller study, we chose to focus on children who scored one standard deviation or more above the mean on the Vineland-II (using the composite standardized score; $n = 16$), and children who scored one standard deviation or more below the mean ($n = 16$) to create groups of children with High Adaptive and Low Adaptive Behavior. We examined their corresponding scores on a variety of cognitive, language, and achievement tests to explore group profiles and compare outcomes against typical expectations described in the literature. We then used a case study approach, utilizing information gathered via developmental history questionnaires and brief interviews with parents, to examine in greater depth the individual profiles of six children who have performance profiles that are notably similar to or unlike performance profiles observed in developed countries: three in the High Adaptive Group, and three in the Low Adaptive Group. By looking at the social and cultural contexts that have fostered these selected individuals, we attained unique illustrations of instances in which particular family environment, culture, or circumstance may influence and shape the academic and adaptive skills of these children in this rural area of a developing country. Additionally, we collected

information that may be useful for identifying developmental milestones that are appropriate to this culture and may be incorporated into future adaptive scales for this region.

Adaptive Behavior, Cognitive Ability, and Academic Achievement

Since its utilization in the diagnosis of intellectual disability (ID), adaptive behavior has been studied to clarify its definition and its relationship to other constructs and skills (e.g., academic achievement and cognitive abilities). An early study of the relationships between adaptive behavior, using the Adaptive Behavior Inventory for Children (ABIC; Mercer 1979), cognitive ability, using the Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler 1974), and reading and math achievement, as indicated by scores on the California Achievement Test (CAT; Tiegs and Clark 1973) was conducted with a sample of 345 children stratified on race/ethnicity, SES, gender and age (Oakland 1983). In the context of multiple linear regressions, it was found that neither SES nor race/ethnicity affected the prediction of academic achievement by cognitive ability and adaptive behavior in this sample. In addition, no significant contributions from adaptive behavior to the prediction of achievement beyond the contributions from cognitive ability were found. In other words, the two constructs—adaptive behavior and cognitive ability, while remaining distinct theoretical constructs—were found to provide mostly shared, rather than unique, variance to the prediction of achievement in this study.

Using data gathered in the standardization exercises of the Vineland Adaptive Behavior Scales (Sparrow et al. 1984) and the Kaufman Assessment Battery for Children (KABC; Kaufman and Kauman 1983), Sparrow and Cicchetti (1985) considered the interplay between adaptive behavior and levels of cognitive functioning. This study found low to moderate correlations between the Vineland and the KABC, indicating relatively independent constructs, with correlations between the Vineland's Communication domain and the KABC, Simultaneous Processing and Knowledge (formerly called Achievement) sections being the highest. This was expected as the Vineland's Communication domain includes a section involving the understanding and use of written symbols (writing). An additional study using the same data was carried out by Keith et al. (1987a), who applied confirmatory factor analysis to determine the best model to describe the relationship between adaptive behavior and cognitive ability—identical, completely unrelated, or separate but related constructs. The last model proved to fit the data the best. This model of adaptive behavior and cognitive ability as two separate but related constructs was confirmed by subsequent studies by the same group looking at preschool and low ability school age children. Causal path analysis further indicated that adaptive behavior has a significant effect (predicting 12% of the variance in achievement) even after other variables, such as SES, ethnicity, and cognitive ability have been taken into account (Keith et al. 1987b).

Results from a more recent longitudinal study (diSibio 1993) on the predictive validity of cognitive ability and adaptive behavior for academic achievement further support the findings indicating that intelligence and adaptive behavior are separate but moderately related constructs. DiSibio assessed 51 typically developing kindergarten children using the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R; Wechsler 1989) and the Vineland Adaptive Behavior Scale-Classroom Edition (Sparrow et al. 1985). These scores were then compared 2 years later with the children's 2nd grade achievement in reading, spelling, language, and math. Achievement was more closely related to cognitive ability; however, significant additional contributions from adaptive behavior (11% for all types of achievement, over and above 44% contributed by the WPPSI indicators) beyond that explained by the WPPSI-R were found for reading, language, and math achievement. It has been suggested, though, that adaptive behavior ratings obtained through observation or

teacher interviews tend to correlate more highly with cognitive scores than ratings obtained from parent interviews (Harrison 1989).

Although a small study examining associations between the Vineland and the Wechsler Intelligence Scale for Children (WISC-III; Wechsler 1991) showed a near zero correlation between the Adaptive Behavior Composite Score and the Full Scale IQ score, with correlations expected only on the Communication domain (Sparrow et al. 2005), the general consensus among various larger studies establishes the constructs of adaptive behavior and cognitive ability to be only moderately related, generally separate and largely independent (diSibio 1993). Additionally, the communication skills domain tends to be related most strongly to cognitive ability, whereas the social domain appears to be related to cognitive ability least strongly (Bruininks and McGrew 1987; Harrison 1985; Lambert 1978). And while findings on the associations of adaptive behavior to achievement vary across studies, these studies used different instruments to measure adaptive behavior (Christian and Alone 1973, using the Adaptive Behavior Scale (Nihira et al. 1969); Oakland 1980, using the Adaptive Behavior Inventory for Children (Mercer 1979); Harrison 1981, using the McCarthy Scales of Children's Abilities (McCarthy 1972), so their results are difficult to compare directly. Some, but not all, of the studies (mentioned above) on this topic using the Vineland found significant effects of adaptive behavior on academic achievement, even after accounting for the contributions of cognitive ability. The lingering questions on the nature of the influence of adaptive behavior on academic achievement, and the relationship between adaptive behavior cognitive ability, in non-referred or typically developing individuals still remain. It has been noted that relatively few studies have been carried out with such children (Pearson and Lachar 1994), and the studies that have been are inconclusive on these points.

With this in mind, we describe our own translation and adaptation of the Vineland Adaptive Behavior Scales-II (Vineland-II; Sparrow et al. 2005) for Zambia and delineate the results of a study of adaptive behavior, cognitive ability, and achievement in a small sample of children from a cluster of rural Zambian communities. We then present a set of case studies to illustrate the cultural or situational factors that may have contributed to their performance.

The Translation and Adaptation of the Vineland-II for Southern Province, Zambia

The Chitonga version of the Vineland-II was created for this study in 2009; a 2005 translation in Chinyanja, another language spoken in Zambia (Stemler et al. 2009), provided some guidance on possible issues of adaptation. We could not assume age-related start points (as they are established for the US population) and thus administered all items, except for infant items (start point below 1 year of age), clearly pertaining to children well below the age level of our sample (ages 7–17). An initial translation was carried out by a native speaker of Chitonga, then back-translated by a second native speaker, both in Zambia. Further refinement of the scale's items was carried out, after piloting, in a group setting with four more Chitonga speakers, who would also be the Vineland data collectors; a native Zambian graduate student/lecturer at the University of Zambia, bilingual in English and Chitonga, who had experience administering the Vineland in Chinyanja and who lived in a nearby and demographically similar part of Zambia as a child; and a researcher from the US. Guidance was also provided by Dr. Sara Sparrow, the primary author of the scales and a Vineland expert. During this process, both large scale and item-level changes were adapted to the culture of the area. First, it was decided that the Writing section of the Communication domain would be removed. This was due to concerns related to construct validity of the section which arose during piloting; these concerns were attributed to the report that children do not demonstrate this skill often in the home setting and thus parents might not be able to accurately evaluate this skill. Also because parents might not have well-

developed literacy skills themselves. Next, specific items were examined for cultural appropriateness. For example, in Daily Living Skills, Personal, the item “Washes and dries face using soap and water” was altered to “Washes face with water” because soap is not always available nor is it routinely used to wash the face in that region. In Daily Living Skills, Community, the item “Uses savings or checking account responsibly...” was removed as not appropriate to the culture. Following the translation/adaptation process, data collectors were then trained in the delivery of the Vineland's semi-structured interview.

After data had been collected from 134 parents or caregivers, it was reviewed for item performance and caregiver's knowledge. First, items having too many “Don't Know” responses (DK) or “No Opportunity” responses (N/O) were scrutinized. For example, “Eats with fork, may spill” (Daily Living Skills, Personal) had been scored N/O for 86 of the 134 caregivers. This is consistent with the fact that most Zambians living in this part of rural Zambia eat with their hands and do not even own utensils; if they do, only a spoon would be most likely to be used. Thus, the item did not appear to represent an appropriate indicator of adaptive behavior in that culture. Similarly, “Checks all directions when he/she wants to cross the road” (Daily Living Skills, Community) had been scored DK for 45 caregivers. This is consistent with the fact that cars and traffic are not common concerns in the region, thus such a skill does not appear to be taught and monitored generally by caregivers. In total, 11 such items were removed from the data. Next, those children (20) who had 15% or more missing items within any single subdomain due to lack of information (DK) or opportunity (N/O) were removed from the data set. Although this cutoff of 15% is higher than what is acceptable on the standardized Vineland, this seemed appropriate for this sample, as we were assessing cultural acceptability and relevance. Scores were then re-scaled and ordered by difficulty, and items were examined for misplacement in order of difficulty. For example, items concerning the child's ability to demonstrate understanding of the words “no” and “yes” (Communication, Receptive), though in the original version are low level items for children, were ranked among the latest to develop, therefore most likely they were misunderstood (by parents and data collectors alike) due to their unexpected elementary nature. Similarly, some items ranked among the first acquired skills seemed misplaced, and possibly misunderstood in their complexity. These items were removed as well. For later versions of this translation, thought can be given to whether these items are unnecessary and should continue to be eliminated, or whether better cultural adaptations of these items can be provided such that they measure a culturally valid expected developmental skill. In total, 29 such items were removed from the scales for clear misplacement in the item difficulty order. Overall, 75 items, or approximately 25% of the original questions, were removed from this Chitonga translation of the Vineland (see Table 1 for a summary of modifications made to the Vineland and the subdomain internal consistencies). In a series of z tests comparing between-subdomain correlations of the original Vineland-II ($n = 1,270$) with this Chitonga translation ($n = 114$), 45 of the 55 between subdomain (8)/domain (3) correlations for the Chitonga version were identified as being not significantly different from the original. Of the ten low z test comparisons, five can be explained by the ceiling effect observed on the Communication-Receptive subdomain.

The Sample

All of the children who participated in the current study of the Vineland Adaptive Behavior Scales were recruited through a larger study: the Bala Bbala Project, a large-scale ongoing epidemiological study of specific reading disabilities (SRD). All of the schools participating in the Bala Bbala Project are within a single district in Southern Province, Zambia and are within 35 km of the local hospital and research center. As expected, there is some variation in the communities associated with each school (e.g., types of employment available,

support from outside charitable organizations), but the communities are fairly homogeneous, consisting mainly of subsistence farmers.

At each school for the Bala Bbala Project, approximately 50% of the children in grades 3–7 are screened for SRD using the Zambian Achievement Test-Reading Recognition (ZAT-RR; 39 items; Cronbach's $\alpha = .893$) and a phonological awareness measure (PA; 61 items; Cronbach's $\alpha = .926$). The ZAT-RR assesses Chitonga letter knowledge, including printed letters and letter sounds, in a multiple choice format. The PA assesses children's awareness of Chitonga's phonological properties, in multiple-choice and open-ended formats. Items include first and last sound matching, rhyming, syllable segmentation and blending, and elision. The children who perform at or above the 75th percentile or at or below the 25th percentile are selected to potentially participate in additional assessments. Screening for sources of reading difficulty outside of SRD is carried out using assessments for vision, hearing, malnutrition, and some aspects of cognitive ability (i.e., KABC-II, Triangles; UNIT, Symbolic Memory). The Universal Non-Verbal Intelligence Tests-Symbolic Memory (UNIT-SM; 30 items; Cronbach's $\alpha = .793$) assesses the ability to hold in short term memory and reproduce arrays of meaningful symbols. The Kaufman Assessment Battery for Children, 2nd Edition, Triangles (KABC-II-Tr; 27 items; Cronbach's $\alpha = .848$) assesses simultaneous visual processing; children use manipulatives to reproduce two-dimensional pictures composed of simple shapes. Children who are below the minimum threshold for any of these further screening measures are excluded from the study.

The selected sample of children are then assessed on a number of reading-related and school achievement tasks, including the Zambian Achievement Test-Reading Comprehension (ZAT-RC; 21 items; Cronbach's $\alpha = .901$), which assesses Chitonga reading comprehension using a multiple choice format, and the Zambian Achievement Test-Math (ZAT-M; 55 items; Cronbach's $\alpha = .923$), which assesses math concepts and calculation from number recognition and counting to division and calculating averages, using a multiple-choice format. In addition, caregivers are interviewed using the Vineland Adaptive Behavior Scales-II (Vineland-II; Sparrow et al. 2005). The ZAT, the UNIT-SM, and the Vineland-II were delivered in Zambia in the Chinyanja language, previously, with results that suggested an adequate translation/adaptation (see Stemler et al. 2009 for more on the Chinyanja version of all of the above assessments).

The sample enrolled from the first four schools to take measures of reading comprehension (ZAT-RC) and math (ZAT-M), and their caregivers interviewed using the Vineland-II, and who had sufficient amounts of Vineland responses, consisted of 114 children from grades 3–7, 57 males and 57 females, with a mean age = 12.94 (sd = 2.34).¹ For this smaller comparative study on adaptive behavior, those children who had standardized composite Vineland scores one standard deviation or above, with no missing data in the key subtests for comparison, were selected as the High Adaptive Group (n = 16; grades 3–6, 5 males and 11 females, mean age = 11.82, sd = 1.89). Those who had standardized Composite Vineland scores one standard deviation or below were selected as the Low Adaptive Group (n = 16; grades 3–6, 10 males and 6 females, mean age = 12.40, sd = 1.85). The resulting sample thus consisted of 32 individuals from grades 3–6, 15 males and 17 females, with a mean age of 12.11 (sd = 1.86). Below, we present the correlations (with the larger sample, n = 114) and t test results (with the smaller sample, n = 32) for this sample. We also present six case studies: three from the High Adaptive Group and three from the Low Adaptive Group. We discuss the implications of the similarities and differences between these and other

¹This mean age, in a culture where children start 1st grade typically at the age of seven, may seem high by Western standards. It is most likely this high due to children repeating grades or taking time away from school.

international results, and the possibilities for further exploration of these cross-cultural issues and for improvement of the Chitonga version of the Vineland-II.

Results

A correlation analysis was performed to investigate the associations between the ability indicator (KABC-II-Tr and UNIT-SM averaged and standardized), the subdomain and composite scores of the Vineland, the reading screener indicators (phonological awareness, PA, and letter knowledge, ZAT-RR), and the achievement tests (reading comprehension, ZAT-RC and math, ZAT-M; see Table 2 for the results). As shown in the correlation table, while the domains of the Chitonga version of the Vineland correlated well with each other (ranging from .51 to .72, $p < 0.01$), the correlations between the Vineland and indicators of ability and achievement diverged from the patterns encountered in samples generated in the United States. In our Zambian sample, all Vineland domain scores and the composite score showed no significant correlations with the ability score. These results suggested that in the rural Zambian communities where these data were gathered, adaptive behavior and cognitive ability may be separate constructs. However, the Vineland did show some small significant correlations with reading-related scores, specifically the communication domain with the letter knowledge subtest, ZAT-RR ($r = .34$, $p < 0.01$), the Vineland composite score with letter knowledge ($r = .27$, $p < 0.01$), and the communication domain with reading comprehension (ZAT-RC) ($r = .24$, $p < 0.05$). These correlations largely reflected the presence of associations with the Vineland communication domain. There were no associations between the Vineland and math (ZAT-M) scores. In contrast, cognitive ability correlated highly and significantly with all of the reading-related subtests (.51–.53, $p < 0.01$), but, again, not at all with math. An interesting point to be explored in depth at some other time is the moderate negative correlation that was shown here between reading-related subtests and math (−.35 to −.37, $p < 0.01$). That is, math-related (numeracy) and reading-related (literacy) skills appear to have developed in this sample in distinctly separate trajectories.

To explore in more depth the relationship between adaptive behavior, cognitive ability, and academic achievement in our particular Zambian context, we selected High and Low Adaptive Groups from above and below one standard deviation from the mean (described above), and conducted a series of paired *t* tests between these groups on cognitive ability, performance on the subtests of the reading screener (PA and ZAT-RR), and reading comprehension (ZAT-RC) and math (ZAT-M) (see Table 3 for *t* test results and Fig. 1 for the corresponding graph). Of the components listed, all showed significant or trend differences between the mean scores of the two groups except math. This generally aligns adaptive behavior, at its extremes, as closely related to reading and its related skills, somewhat related to cognitive abilities, and not at all related to math. The reasons for this particularly strong relationship with reading, though, are not clear. A look at the individuals within both the High and Low Adaptive Behavior Groups show some mix of both good and poor readers in each group, as well as varied performance on the cognitive tests. To investigate more closely the connection between adaptive behavior and reading skills (we will explore issues of mathematics, due to space constraints, elsewhere), we now present six case studies, three from the High Adaptive Group and three from the Low Adaptive Group, to explore the nature and possible sources of these differences (see Table 4 for these children's scores).

From the High Adaptive Group

Twaambo²

Twaambo is an 11 year old girl in the 4th grade. She achieved a composite score on the Vineland at about one standard deviation above the mean, with her lowest score in the socialization domain; she has some difficulty getting along with others. However, she performed very well on the reading screening indicators, with a cognitive ability score about two standard deviations above the mean. Her reading comprehension score and math score reflect above average performance. According to information gathered in parent interviews beyond the Vineland, Twaambo enjoys a stable family life, having lived with her mother, father, grandmother, and three sisters and one brother for at least the past 2 years, with no recent major disruptions. Her father attended secondary school, and in conversation he expressed pride in his daughter's good school performance and ability to work hard. By his account, her favorite activities and best skills are related to Bible lessons at church and memorizing Bible verses, and the skills that he has deemed most valuable from her schooling are reading and writing. Yet, at the same time, her knowledge of hygiene, cooking, and child care without parent supervision are also highly valued as important measures of learning and accomplishment. The expectation is that she will eventually attend nursing school.

These facts describe a positive home life that supports and encourages achievement and hard work in all areas of life. Twaambo's very high scores on abstract performance tasks (the cognitive tests) versus relatively lower scores in reading and math achievement may reflect a high general ability that is more exerted in the areas of home and church—more family related activities—than in classroom subjects.

Milimo

Milimo is a 14 year old boy in the 6th grade with high adaptive behavior despite challenges in his home life; his mother and father separated about 4 years ago and he has been living with his father and some extended family members since. Milimo entered school when he was 10, which is later than average, but he skipped the 1st grade. His father only has a primary school education, which is common in rural Zambia.

Despite the challenges he has faced in his home life and his atypical educational experience, Milimo has mastered appropriate adaptive behavior and some school achievement skills. He has a high Vineland score with respect to his peers. His greatest strengths are in the domains of daily living and socialization. His reading-related and cognitive ability scores are more than one standard deviation above the mean or are at least above average. His math score is low but within one standard deviation of the mean.

Milimo's father says that the most important skills his son has learned in school is to read and write in Chitonga, which coincides with Milimo's assessment scores, but his father also states that Milimo is not active at school, that he is unsure of his son's future, and that his son's greatest skill is playing soccer, giving the impression that Milimo is not as engaged in school activities as other children. In spite of this perception, Milimo appears to have managed to develop and learn at a generally high level. He exemplifies the individual variation in both experience and performance that exists in rural Southern Province, Zambia and how children can achieve in school and life even when faced with trying experiences or when not exhibiting clear direction.

²The names presented in these case studies are not the real names of the children.

Mutinta

Mutinta is an 11 year old girl who is in the 5th grade. She demonstrated a composite score on the Vineland at about one standard deviation above the mean, with strengths in daily living skills and in socialization, but with average adaptive communication. Mutinta manifested some difficulty with all of the reading related tasks, but showed better than average math skills. Her cognitive ability score was nearly one standard deviation below the mean. Mutinta lives with her parents, two younger brothers, and two younger sisters. Her mother, the respondent, praised her sense of responsibility and her domestic skills, commenting that she is obedient, truly enjoys “kitchen life” activities such as cooking and washing dishes, and is a skilled cook. Mutinta's mother admits that Mutinta has difficulty with academics, particularly reading, but not math. She imagines that Mutinta will be a capable homemaker and perhaps work in a store given her math skills and some current experience doing so. She is reported to have gained a great deal of maturity recently.

Mutinta is representative of children who have moderately low cognitive ability and who might thus struggle with reading and language activities, yet carve niches for themselves based on their strengths. She is social, intuitive in meeting the domestic needs of her family (perhaps in part due to being the oldest and having baby siblings), and capitalizes on her math skills particularly as they apply to functional skills such as shop work.

From the Low Adaptive Group

Lushomo

Lushomo is 13 and in the 5th grade. She lives with her mother, father, and siblings, both older and younger. Within the last 2 years, Lushomo has been seriously ill and lost a younger sister, both of which may have had an impact on her development and academic achievement. Her mother notes that Lushomo was absent from school due to her health problems 2 years ago, as well as due to flooding on her route to school during the rainy season.

Lushomo's Vineland score is low. Communication is her strongest domain and socialization is her weakest, but they are all relatively low in comparison with her peers. Yet, Lushomo's mother is proud of her daughter's abilities and potential. She said that her daughter has shown development personally (i.e., in her own personal hygiene), at home (i.e., cooking, watching younger siblings, washing dishes), and academically (i.e., in her reading abilities). In her future, Lushomo's mother expects Lushomo to become independent. She said that her daughter wants to be a nurse or teacher and will likely achieve her goals since she puts forth effort at school.

There is more variability in Lushomo's performance on the other assessments, with her cognitive ability score and math score about average, while her reading-related scores are all more than one standard deviation above the mean; she has strengths in some academic areas and impresses her mother as having potential. Lushomo illustrates that while academic achievement is associated with adaptive behavior, the two can be independent. Moreover, it appears that the challenges that Lushomo has faced in recent years (i.e., losing a sister, illness, absenteeism from school) have not affected her development and learning uniformly.

Nkomo

Nkomo is a 16 year old boy in the 5th grade. He is the older sibling of Lushomo (see above), who is also in the lower Vineland group, and also in the 5th grade. Nkomo scored nearly two standard deviations below the mean on the Vineland composite, with difficulties in all domains but a particularly low score in socialization. Nkomo was reported to engage in most

interpersonal activities only sometimes, and to not understand the subtleties such as gestures and other unspoken communication necessary to relate effectively to others. He only sometimes engages in play and leisure activities, and is not a good sport (can be a sore loser). He sometimes shows good manners, sometimes controls frustration and impulsive behaviors, but has difficulty apologizing and keeping promises. However, his scores on the cognitive ability indicators are average, and he is a skilled reader though with poorly developed math skills.

Nkomo lives with his parents and siblings, but he lost a younger sister in the past year. Because of at least one move, he currently speaks two Bantu languages, Chitonga and Chinyanja. Nkomo's mother reports that Nkomo is an underachiever in school, and that he has repeated two grades upon his father's request. Despite his poor attendance, repeated grades, and daily underperformance, he has managed to achieve advanced reading-related skills. At home, he is not particularly compliant with chores, and has not yet "shown himself" regarding his future goals or potential. A teenager who is on the cusp of adulthood, Nkomo appears to be struggling to find his way. He is a smart, accomplished individual who appears to be significantly underperforming at home and at school.

Choolwe

Choolwe is an 11 year old boy attending the 4th grade, living in a currently stable but recently ravaged home situation. According to his caregiver, a self-described "aunt," both of his parents passed away in the last year, leaving Choolwe and a younger brother orphaned. According to his test scores, Choolwe performed at about one and a half standard deviations below the mean on phonological awareness, and one standard deviation below the mean on letter knowledge and the cognitive ability indicators. His Vineland scores are below two standard deviations below the mean across all domains and the composite, reflecting very low adaptive behavior.

However, Choolwe's low performance is not uniform: he shows close to average performance on math for a child his age. Although his aunt describes Choolwe's school performance in terms of probable failure—at her request to the school he is repeating 4th grade—his ability to carry out home chores, such as goat herding and farm work, are spoken of positively. One of his favorite activities is playing soccer, so he is physically able. The situational factors at work here are heavy: Choolwe has been described as having AIDS, and as having had cerebral malaria at age three. Also, he is an orphan living in an only recently stabilized family situation, with a family whose educational background is low (his aunt only attended primary school), and whose economic resources are low. Yet, Choolwe has acquired certain useful skills, in both farming and animal care, as well as the basics of math. And, he knows how to have fun playing games with his friends. Therefore, we might interpret this portrait as one of resilience, which may express itself in a profile of adaptive behavior, cognitive ability and achievement that is not generally seen, nor well understood from a Western point of view.

Discussion

We begin our discussion of findings with a reminder of where these findings were obtained, with a look at the contextual factors that predominate for this population, both economic and educational. Zambia is a resource-poor country in sub-Saharan Africa in which many people are young (nearly 59% of the population is nineteen years old or younger according to the 2000 Zambian census, <http://www.zamstats.gov.zm/census.php>) and living in poverty (the World Bank reports that in 2004/2005, 64.29% lived on USD \$1.25 or less per day and 90.81% lived on USD \$3 or less per day, http://siteresources.worldbank.org/INTPOVERTY/Resources/data_afr_1.pdf). Project staff members, who are from the same communities as

the children in this study, report that most children go to school, but that few preschools exist and most children do not have any formal education before they begin 1st grade at age 7. Area schools have large class sizes, do not have sufficient supplies, and children are frequently absent, most typically for family obligations and illness. Families are large, sometimes practicing polygamy and often including extended family relations. Efforts to control and treat serious illnesses (e.g., malaria, HIV/AIDS) and malnutrition have been effective, but children in this part of Zambia still commonly experience or live in families coping with serious illness or malnutrition.

The effects of such an environment surely impact children's adaptive behavior, and in ways that create patterns of development and achievement that are necessarily different from those observed in other lands and other cultures. The first notable difference here is the non-existing or low association between adaptive behavior and cognitive ability, as measured in our sample. Though Western samples routinely exhibit moderate correlations between adaptive behavior and cognitive ability (as per the studies cited above), our Zambian correlations between these constructs was low and insignificant, even while the cognitive ability measure showed high and significant associations to reading related skills. Yet, as Sparrow et al. (2005) asserted, there is no objective reason for adaptive behavior and cognitive ability to be even moderately associated; to what degree they are related appears to depend upon the culture. For example, similar associations have been found in other studies carried out in developing countries and indigenous cultures, in which the Western-based measures of cognitive ability have proven to be more closely related to school achievement than to more community/culturally-based notions of what is useful or intelligent behavior—i.e., practical intelligence, involving the acquisition and application of knowledge in daily living, such as the use of locally grown herbs and medicines, which construct is much more closely aligned in essence with adaptive behavior (Grigorenko et al. 2001, 2004; Prince et al. 2001). Serpell and Jere-Folotiya, in their studies of intelligence in rural Zambia, found “ecocultural” or “home cognition” to be distinct from “school cognition” (Serpell and Jere-Folotiya 2008, p. 88). In such cases, in which school or more achievement-related cognitive abilities and adaptive skills are generally developed in distinct environments (school vs. home life), they may develop as completely unrelated sets of abilities. While the case of Twaambo (see above) illustrates the fact that an individual may certainly develop high abilities in both areas, the story of Mutinta exemplifies the development of strong adaptive skills, particularly in activities of daily living such as cooking and homemaking, though her cognitive and achievement scores are low.

The second interesting outcome we observed from our study is the relationship between reading-related abilities in our High and Low Adaptive Groups, with significant differences in performance on these abilities (but not cognitive ability nor math achievement) between the two: high adaptive skills being associated with high reading-related skills and low adaptive skills being associated with corresponding low reading-related skills (see Table 3; Fig. 1 for t test results). Why might this be the case, especially since such an academically related skill as reading might be expected to be aligned more closely with cognitive ability, even in this small sample? We speculate that the answer may lie in the nature of schooling in the communities from which our sample was drawn, as well as the cultural/community aspects of life that may contribute to reading abilities outside of school.

First, we note that schooling in rural Southern Province in Zambia is not comparable to the schooling environments found in Western developed countries, and the following conditions might contribute to some of the unexpected variation in reading-related abilities that we find in this sample. Student absenteeism is common. In a study by Lungwangwa et al. (1999), distance from schools was cited as a factor affecting school attendance, with almost 20% of children in rural areas living more than 5 km from school. In 2002 (Mumba 2002), long

distances were also cited as a reason for non-attendance at school, along with poverty, negative attitude and/or low valuation of education by parents, pregnancies, and inadequate school facilities. From our own study, we know that factors such as illness, the need to work, and weather—like the floods that prevented Lushomo from getting to school—also remain an obstacle to school attendance. We also know that teacher absenteeism is not uncommon, due to illnesses such as HIV/AIDS (Grassly et al. 2003) or other employment (e.g., census-taking) or family obligations (e.g., an ill parent or child); there is no system of short-term substitute teachers in this area of rural Southern Province other than teachers attending to multiple classes simultaneously. Finally, the higher prevalence of negative life circumstances for which there is no system of support or counseling for children may interfere with their ability to learn, such as in the case of Nkomo. All of these factors, as well as many others we do not have the space to explore here, may contribute to children's inconsistent acquisition of reading skills in school.

But then why might those, such as Milimo, with higher adaptive behavior be attaining a higher level of reading skills (and not math skills)? One possible answer might lie in the fact that in the particular communities/culture in which we worked, we observed a high degree of exposure to language and the ability of children to sit still (if not pay attention) while being spoken to. We note this in the ceiling effect exhibited in the Vineland's Receptive Communication subdomain in this sample, as well as in the children's behavior at church, in school, and with our own data collectors. But an even more powerful effect may be the prevalence of religion in rural Zambia, in which over 70% of the population is Christian—about 30% Roman Catholic, 30% Protestant, and the last 40% a mix of various gospel Christian groups, including Seventh Day Adventists and Jehovah Witnesses (Carmody 2006; Gifford 1998).³ Children are exposed at a very young age to religion, which engages them in highly verbal activities, from listening to sermons to memorizing verses and hymns to possibly learning to read bits of the Bible (if there is a Bible in the home). Children who are apt to develop high levels of adaptive skills are characterized, by definition, as those who engage in levels of social behavior that are guided by societal expectations. These, like Twaambo—whose favorite activities and highest level skills are associated with Bible lessons and memorizing Bible verses—may acquire reading-related language skills as part of their practice of adaptive behavior within a highly verbal religious environment.

Bornstein et al. (2005), in a comparative study on adaptive behavior in children in the US and Italy, in both urban and rural environments, concluded that any satisfactory explanation of group differences in adaptive behavior will most likely involve the interaction of biological, psychological, and social factors. Our small study re-iterates this. Though limited in scope in drawing from fairly homogeneous, small, rural communities in Southern Province, Zambia, and using instruments which originated in a different culture (although we continue to take careful steps to investigate their validity), we have begun to tease out the cultural, health-related, economic and political infrastructural factors that may affect the development and expression of adaptive behavior and its relationship to cognitive ability and academic achievement in this under-studied population.

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³Particularly common in the area where the Bala Bbala Project is underway are the Brethren in Christ and Seventh Day Adventists Churches.

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Fig. 1.

T test profiles: Group means for the high adaptive and low adaptive groups (N = 16 for each group) were standardized and the effects of age removed using regression. The differences between these group means were then compared in these t tests. Differences between PA, ZAT-RR and ZAT-RC mean scores were significant (two-tailed, $p < .05$)

Table 1

Number of items removed from the Vineland in the process of translation, adaptation and item analysis; number of items remaining for each subtest bolded for emphasis; subtest internal consistencies

Vineland Section	Original # of items	Infant items not administered	Items dropped during adaptation	Items dropped due to DK, N/O occurrence	Items dropped in difficulty analysis	Total dropped	# Items remaining	Cronbach's alpha
Comm-r	20	3	0	0	3	6	14	.801
Comm-e	54	7	0	1	6	14	40	.846
Comm-w	25					All	0	
DLS-p	41	3	2	3	5	13	28	.846
DLS-d	24	0	0	2	0	2	22	.927
DLS-c	44	0	7	4	2	13	31	.946
Soc-i	38	10	0	1	5	16	22	.895
Soc-p	31	3	1	0	3	7	24	.918
Soc-c	30	0	0	0	4	4	26	.920

Comm-r communication, receptive; *Comm-e* communication, expressive; *Comm-w* communication, writing; *DLS-p* daily living skills, personal; *DLS-d* daily living skills, domestic; *DLS-c* daily living skills, community; *Soc-i* socialization, interpersonal; *Soc-p* socialization, play and leisure; *Soc-c* socialization, coping

Number of items removed from the Vineland in the process of translation, adaptation and item analysis; number of items remaining for each subtest bolded for emphasis; subtest internal consistencies

Table 2

Correlations between domains of the Vineland, academic achievement and the cognitive ability indicator

	1	2	3	4	5	6	7	8	9
1. Comm	1								
2. DLS	.56 ^a	1							
3. Soc	.51 ^a	.72 ^a	1						
4. Comp	.80 ^a	.89 ^a	.87 ^a	1					
5. PA	.16	.14	.04	.13	1				
6. ZAT-RR	.34 ^a	.19 ^b	.17	.27 ^a	.73 ^a	1			
7. ZAT-RC	.24 ^b	.17	.12	.21 ^b	.82 ^a	.74 ^a	1		
8. ZAT-M	-.09	.06	.04	.00	-.35 ^a	-.36 ^a	-.37 ^a	1	
9. Cognitive Ability	.16	.14	.15	.18	.51 ^a	.48 ^a	.53 ^a	-.06	1

Comm VINELAND-II communication domain, DLS VINELAND-II daily living skills domain, Soc VINELAND-II socialization domain, Comp VINELAND-II composite score, ZAT-RC reading comprehension, N = 99; ZAT-M math, N = 95; Cognitive ability N = 113; all other N = 114

^aCorrelation is significant at the 0.01 level (2-tailed)

^bCorrelation is significant at the 0.05 level (2-tailed)

Table 3

T test results (N = 32, 16 high adaptive, 16 low adaptive)

Subtest	High adaptive mean (sd)	Low adaptive mean (sd)	t	df	p
PA	.93 (.81)	.07 (.129)	-2.26	30	.03
ZAT-RR	.89 (.78)	-.15 (1.12)	-3.03	30	.004
ZAT-RC	.64 (.68)	-.26 (.84)	-3.34	30	.002
ZAT-M	.10 (1.15)	.19 (.85)	0.25	30	ns
Ability	.56 (1.12)	-.09 (.98)	-1.73	30	.09

Table 4

Case study scores for the Vineland, academic achievement, and cognitive ability

Case study	High adaptive group				Low adaptive group			
	Twaambo	Milimo	Mutinta	Lushomo	Nkomo	Choolwe		
Age	11.70	14.76	11.36	13.01	16.01	11.59		
Grade	4	6	5	5	5	4		
Respondent	Father	Father	Mother	Mother	Mother	Aunt		
Gender	F	M	F	F	M	M		
Vineland communication	117.29	107.21	106.32	82.95	86.57	65.49		
Vineland daily living skills	120.56	120.06	120.57	74.98	72.93	74.26		
Vineland socialization	112.04	120.52	119.73	68.80	55.52	64.49		
Composite Vineland	119.47	118.65	118.19	71.40	66.84	62.63		
PA	119.67	124.58	99.74	125.09	124.97	76.34		
ZAT-RR	128.46	113.56	89.78	117.68	111.61	85.00		
ZAT-RC	108.33	116.30	94.24	115.24	105.05	94.24		
ZAT-M	113.07	90.60	102.64	94.09	92.18	101.09		
Cognitive ability	123.16	105.82	89.04	102.95	103.66	88.09		

All scores are standardized, M = 100, sd = 15