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How children living in poor areas of Dar Es Salaam, Tanzania perceive their own multiple intelligences

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ABSTRACT
This study was carried out with 1,857 poor children from 17 schools, living in low-income areas of Dar Es Salaam, Tanzania. All children took the ‘Student Multiple Intelligences Profile’ (SMIP) questionnaire as part of a bigger project that gathered data around concepts and beliefs of talent. This paper sets out two aims, first to investigate the structural representation of the self perceived multiple intelligences for this set of children and second to discuss how the best fit model might reflect children’s culture and their school experiences. After carrying out exploratory factor analysis, a four factor first order model was shown to have a good fit. A higher order factor solution was investigated owing to the correlation of two latent constructs. In order to provide some insight into the multiple intelligences construct the relationship between the SMIP items, student test outcomes and attitudes to learning were examined. The item groupings were explored through African cultural beliefs around intelligences indigenous to African communities.

Introduction
problems regarding measurability (Visser et al., 2006). Gardner (2006a) himself concedes that tests need to be ‘intelligence-fair’ focusing on the intelligence that is to be measured (p. 504).

Regarding the assessment of MI, Gardner, Feldman & Krechevsky (1998) created ‘Project Spectrum’ in order to ascertain the intellectual profile of children in a manner that was as natural as possible. Alternative assessment was utilised to identify and evaluate student abilities using performance-based assessment with respect to MI theory. Similarly the ‘Discovering Intellectual Strengths and Capabilities (DISCOVER) Projects’ set out to measure three of the MI intelligences—spatial, logical mathematics and linguistic—through problem solving performance based assessment. Two of the other intelligences, inter and intrapersonal, were also assessed through observation (Maker, Nielson & Rogers, 1994). Udall and Passe (1993) developed the ‘Multiple Intelligences Assessment Technique’ (MIAT) to assess four of the multiple intelligences, through performance based activities, teacher ratings and observations. This technique was used in the project ‘Support to Affirm Rising Talent’ (START) (Plucker, Callahan & Tomchin, 1996). There are various self-reporting MI assessments including the ‘Student Multiple Intelligences Profile’ (SMIP) questionnaire and the ‘Multiple Intelligences Developmental Assessment Scales’ (MIDAS), which is used in career counselling (Chan, 2001; Shearer & Luzzo, 2009). Although Gardner believes that self-reporting may have problems concerning reliability he does not dismiss such assessments of MI stating that:

much can be learned about how people conceive of themselves, and through comparisons of response patterns found among and across different groups of subjects. (Gardner, 2011, p. xiv)

Some research has grouped these multiple intelligences (MI) into conceptual clusters (Bennett, 1996, 1997; Chan, 2006; Furnham, 2001). Indeed, Campbell, Campbell & Dickinson (2004) classified Gardner’s eight intelligences into three clusters—personal related, object related, and object free intelligences. Nevertheless, however viewed or grouped, the theory of multiple intelligences (MI) ‘provides one useful framework for understanding individuals’ basic competencies, as well as their unique strengths’ (Chan, 2006, p. 326). It also provides one possible strand of the identification process through the self-perception or self-estimation of one’s intelligence (Bennett, 1996, 1997, 2000; Furnham, 1999, 2000; Petrides & Furnham, 2000).

Although popular in other country settings no sub-Saharan Africa study has been found that uses a performance-based assessment. A couple of studies have been carried out in Africa around multiple intelligences that use the self-estimate approach. One study was undertaken in Namibia, South Africa, Zambia and Zimbabwe regarding parental estimates of their own and their children’s multiple intelligences (Furnham & Akande, 2004). A total of 421 parents were asked to rate where they believed their own and their children’s scores for seven intelligences lay along a normal distribution curve. The data show that Namibians were more likely to give the lowest self-estimates and Zambians the highest self-estimates. Females gave higher self-estimates than males on all seven multiple intelligences. A similar study in Nigeria and South Africa (comparing White and Black South Africans) used the same questionnaire around self and relatives’ estimates of multiple intelligences (Furnham, Callahan & Akande, 2004). The research, in contrast to Furnham and Akande (2004), found few gender differences in estimates. When looking at ratings of White and Black South Africans, White South Africans tended to rate their relatives more highly than Black South Africans. The SMIP however, has not been used in an African setting with adults or children in order to rate multiple intelligences. It has been used predominantly in China and Hong Kong.
African cultural practices, beliefs, attitudes, rituals, customs, values and communication styles all influence the definition, attributes and characteristics of the concept of intelligence (Mpofu, 2002, 2004; Ngara & Porath, 2004). Concepts of intelligence can be based on what is socially meaningful, built on local, social and environmental conditions (Mpofu, Ntinda & Oakland, 2012). Ugandans have been shown to view intelligence as a social construct. The Shona of Zimbabwe regard intelligence as ‘public-spirited’ behaviour or achievements that could be beneficial to the group (Irvine, 1970, 1988; Weber, 1974). For the Ndebeles of Zimbabwe intelligence comprises wisdom, social responsibility, social constructive disposition, success in life, superior educational qualifications and abilities to problem solve (Mpofu, 1993, 2004). Through villagers’ responses from a rural community in eastern Zambia, Serpell (1977, 1993) found the Chewas divided intelligence into four indigenous constructs— wisdom, aptitude, responsibility and trustworthiness. Wisdom and aptitude represented the cognitive aspects, and responsibility and trustworthiness the social aspects of intelligence. Again with the Luo of Kenya the concept of intelligence could be divided into the two aspects of cognitive and social (Grigorenko et al., 2001). There have been a number of studies in sub-Saharan Africa that have found that children’s performance in village tasks valued by the community (e.g., herbal treatment for local common illnesses) are unrelated to academic achievement (Grigorenko et al., 2001; Serpell, 2007, 1993, 2011b; Sternberg et al., 2001). It is suggested that cognitive values among the Chewa and Luo communities differ from those promoted in schools. As highlighted in other literature, school programmes in sub-Saharan Africa generally conform to Western cognitive values (Kasfir, 1983; Mandaza, 1986; Serpell, 1993; Serpell & Boykin, 1994).

In developing countries typically teachers, government officials and district education officers believe that children from poor areas, who are first generation learners and with illiterate parents, are incapable of possessing talent, incapable of learning, having ability or achieving greatness (Dixon, 2012; Frasier, 1987; Humble, 2015; Iyer & Nayak, 2009). These attitudes transfer into the classroom and thus the educational practices of teachers. In slums and low-income areas of sub-Saharan Africa children typically attend schools where rote learning is the order of the day (Dixon, Humble & Counihan, 2015; Hoadley, 2012; Nomlomo & Vuzo, 2014; Tabulawa, 2013). Rote learning and teaching to the test make it easier for government schoolteachers who have, in the main, become demotivated and removed from their educationalist roles and responsibilities (Chireshe & Shumba, 2011; Kremer, Muralidharan, Chaudhury, Hammer & Halsey Rogers, 2006; Tooley, 2009). School learners are unaccustomed to being asked to use their imagination and think differently to others. Children are never asked to voice their own opinions or think for themselves; just regurgitate information provided by the teacher (Duflo, Dupas & Kremer, 2015; Kremer, Brannern & Glennerster, 2013). Communities value forms of ability that allow a person to meet their social obligations (Nsamenang, 2006). One proxy of intelligence for the Shona and Chewa is life success, which could partly be gained by acquiring literacy skills (i.e., access to jobs, income, improved health and wellness). Therefore schooling is regarded as important in such communities with respect to the acquisition of such abilities (Dasen, 2011; Oslon, 1986; Stemler et al., 2009).

In this study we aimed to explore further the use of self-estimates with poor children in Tanzania regarding their multiple intelligences. We also set out to investigate whether their schooling experience or culture might influence their interpretation of the items. This led us to the following research questions:
- What would be the structural representation of the self-perceived multiple intelligences for this set of children?
- What insights could be given, if any to interpret the children's self-perception groupings given their school experiences and culture?

Method

To look at these questions the SMIP was given to children who were taking part in a project that gathered data—including background information, achievement outcomes, teacher, parent and pupil beliefs—around concepts of talent. The overall aim of the whole project was to identify and nurture talented children from poor areas of Dar Es Salaam, Tanzania.

Chan (2001, 2003) developed the ‘Student Multiple Intelligences Profile’ (SMIP) and subsequently a revised SMIP-24 (featuring 24 items incorporating eight subscales) based on Gardner’s MI. In one piece of research the structure of perceived multiple intelligences was explored with 1,464 primary and secondary Chinese students who were judged to be gifted intellectually, academically or talented in a non-academic area (Chan, 2006, p. 328). Chan’s findings showed there to be a two second order factor model with the eight intelligences grouping into two conceptual clusters of ‘non personal’ intelligences and ‘personal’ intelligences.

Our paper utilised the results of the SMIP questionnaire to investigate the construct of the intelligence structure as applied to these African children. We initially used exploratory factor analysis (EFA) to explore the dimensionality of the SMIP and uncover the smallest number of interpretable factors needed to explain the correlations among them. The suggested empirical model was evaluated using confirmatory factor analysis (CFA) to investigate how well the pre-specified factor solution obtained from EFA reproduced the sample data matrix of the measured variables.

Participants

A total of 1,857 primary students living in poor areas of Dar Es Salaam in Tanzania were asked to complete a questionnaire and undertake tests as part of an Economic and Social Research Council (ESRC) funded project. Students in groups of 40–50 completed the tests/questionnaires. Tests included a non-verbal ability test, mathematics, English reading and Kiswahili tests. The study also included teacher interviews, parent interviews and household surveys. All students and their parents were informed through their schools that the purpose of the assessment exercise was to assess the strengths or talent areas of the students, that participation was voluntary, and that the results of the assessment would be kept strictly confidential and for research uses only (Humble, 2015). All grade 4 or 5 students in each of the 17 schools participated. No student declined participation, and complete data regarding the SMIP was obtained from 1,829 students. These students were aged between 8 and 15 years old (M=11.02, SD= 1.14).
Measure

This research used a translated version (into Kiswahili) of Chan’s SMIP. This profile was intended to tap children’s talent potentials in seven intelligences. Initially there were 27 items that were refined and modified after consulting various sources on multiple intelligences, including, notably, Armstrong’s checklists (Armstrong, 1994). Seven part-time graduate students who were also full-time secondary school teachers were enlisted to help judge the item content and the appropriateness of these items in reflecting specific intelligences. Each of these teachers also administered the checklist to secondary students to obtain feedback on the ease or difficulty in responding to the checklist. Finally, based on the feedback from secondary students and teachers, 21 items (three items for each intelligence) were retained in the final version. The original 21-item checklist covered seven intelligences: verbal-linguistic, musical, logical-mathematical, visual-spatial, bodily-kinaesthetic, intrapersonal, and interpersonal intelligences (see Chan, 2001). The checklist was revised to include naturalist intelligence by adding three items adapted and modified from the checklist of Armstrong (1994), and these three items were included into the revised 24-item SMIP. According to Chan (2001) the subscales had sound psychometric properties including moderate internal consistency (Cronbach’s α = 0.64 and 0.76) and significant correlations with external measures.

This research utilised the SMIP self-perception questionnaire. The students rated the degree to which they perceived each of the 21 items on the checklist as descriptive of themselves using a five-point scale ranging from 1 (least descriptive of me) to 5 (most descriptive of me). The 21 items in our version of the SMIP questionnaire did not include the set on bodily-kinaesthetic. Children in government primary schools in Tanzania typically do not speak or read fluently in English. Therefore in order to address this, the SMIP was translated into Kiswahili. Initially this was piloted and any amendment regarding language usage was made at this stage, taking the advice of in-country educationalists. It is recognised that there could be potential effects when translating tests to be used cross-culturally. Everything was done to try to minimise such effects. The internal reliability of the new Kiswahili language SMIP form showed a Cronbach’s α equivalent to 0.8, giving some evidence of reliability. In order for children with poor reading ability to still undertake the test, each item was read out in Kiswahili by the researcher, providing time after each item for children to complete the likert scale.

Procedure

Testing took part within the children’s own class in their own schools. Letters were sent home and meetings arranged where requested to explain the project and the whole procedure that was to take place. Testing occurred in the morning for all participants. Education Masters students from the University College Dar Es Salaam administered the tests. They had been given special training from the research principal and co-investigators specifically for the project. This part of the overall testing procedure lasted for around 30 minutes.

Overview of analysis

First we conducted exploratory factor analysis (EFA) to evaluate the dimensionality of the data set of multiple indicators on the SMIP questionnaire to uncover the smallest number of
interpretable factors needed to explain the correlations. The suggested underlying structure, which had been tentatively established from the EFA empirical analyses, was then subjected to a confirmatory factor analysis (CFA).

Results

**What would be the structural representation of the self-perceived multiple intelligences for this set of children?**

**Student Self-ratings on SMIP items.** Exploring gender and age group differences the mean ratings of boys (n=872) and girls (n=957) and those of students of the younger age group (below 11 years; n=960) and older age group (age 11 and above; n=869) are computed separately and compared. Significant gender differences, after adjusting the level of significance for multiple comparisons using the Bonferroni procedure, are observed in three items of the questionnaire. Girls reported themselves as more verbose than boys (girls M = 3.66, SD = 1.38; boys M=3.44, SD = 1.45; t (1827) = 3.387, p<0.001) and rated themselves more highly for honesty and integrity (girls M = 3.61, SD = 1.3; boys M=3.49, SD = 1.33; t (1827) = 1.96, p<0.05). Boys reported themselves as more likely to play an instrument than girls (boys M=2.98, SD = 1.52; girls M=2.71, SD = 1.52; t (1827) = 3.899, p<0.001).

Considering the younger and older groups there is a significant difference where the younger group (aged under 11 years) reported they were more sensitive to others’ feelings than the older group (younger M = 4.08, SD = 1.29; older M=3.95; SD = 1.41; t (1827) = 2.07, p<0.05) and more likely to be watching birds and animals (younger M= 3.67, SD = 1.4; older M = 3.49; SD = 1.47; t (1827) = 2.67, p<0.01). The mean and standard deviations were tabulated in order to look at the self-rating of the 1,829 students regarding the 21-item SMIP. These data are show in Table 1.

**Factor models of perceived multiple intelligences.** Exploratory factor analyses were undertaken in order to test for the smallest number of interpretable factors needed to explain the correlations in the 21 items of the SMIP questionnaire. Gender and age effects were not evaluated.

An initial estimation yielded four factors with eigenvalues exceeding unity, accounting for 40% of the total variance. The chi-squared values computed for the evaluation of the fit for one to seven factor solutions and the corresponding amount of total variance accounted for are summarised in Table 2. The results indicate that a statistically adequate solution, one that yields a non-significant chi-squared, would require a solution beyond the seven factor solution. However, taking 0.001 as the cut off criterion and the eigenvalue equal to one criterion, we submit that the four-factor solution could be regarded as an adequate representation of our data.

It can be noted from the scree test (figure 1) that the point where the graph changes shape and the substantial decline in the magnitude of the eigenvalues occurs is where there are four eigenvalues greater than one. As is pointed out by Gorsuch (1983) the scree test is a good indicator when the sample size is large. A four factor solution is also supported using the logic of the Kaiser-Guttman rule, when an eigenvalue is less than 1.0, the variance explained by a factor is less than the variance of a single indicator.

**Structural representation of self perceived multiple intelligences.** The factor structure uncovered in exploratory factor analyses is shown in Table 3. As can be seen there is a lack of simple
Table 1. Mean and standard deviation ratings of 21 items (n=1829).

<table>
<thead>
<tr>
<th>Questions</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal-linguistic 1 (Lin1) I enjoy talking and playing with words.</td>
<td>3.55</td>
<td>1.420</td>
</tr>
<tr>
<td>Verbal-linguistic 2 (Lin2) I enjoy writing; I am fluent and expressive.</td>
<td>3.92</td>
<td>1.258</td>
</tr>
<tr>
<td>Verbal-linguistic 3 (Lin3) I read a lot for pleasure and information.</td>
<td>3.77</td>
<td>1.289</td>
</tr>
<tr>
<td>Musical 1 (Mus1) I sing, hum a lot.</td>
<td>2.86</td>
<td>1.407</td>
</tr>
<tr>
<td>Musical 2 (Mus2) I enjoy listening to different kinds of music; I can notice different tones and easily remember melodies.</td>
<td>3.15</td>
<td>1.512</td>
</tr>
<tr>
<td>Musical 3 (Mus3) I play instruments; I can easily master the skills of playing.</td>
<td>2.84</td>
<td>1.532</td>
</tr>
<tr>
<td>Logical-mathematical 1 (Mat1) I actively search the patterns, cause-effect, and logical relationships.</td>
<td>2.89</td>
<td>1.400</td>
</tr>
<tr>
<td>Logical-mathematical 2 (Mat2) I collect, categorize, study and analyse things.</td>
<td>3.33</td>
<td>1.438</td>
</tr>
<tr>
<td>Logical-mathematical 3 (Mat3) I play with numbers; I enjoy arithmetic “problems”.</td>
<td>4.01</td>
<td>1.310</td>
</tr>
<tr>
<td>Visual-spatial 1 (Spa1) I remember landmarks and places that I have visited.</td>
<td>3.56</td>
<td>1.418</td>
</tr>
<tr>
<td>Visual-spatial 2 (Spa2) I know directions, can draw and follow maps.</td>
<td>3.45</td>
<td>1.503</td>
</tr>
<tr>
<td>Visual-spatial 3 (Spa3) I enjoy and I am good at drawing, painting, and making models.</td>
<td>3.57</td>
<td>1.376</td>
</tr>
<tr>
<td>Intrapersonal 1 (Sel1) I understand and like myself; I can control my emotions.</td>
<td>3.88</td>
<td>1.408</td>
</tr>
<tr>
<td>Intrapersonal 2 (Sel2) I am self-confident, active and have self-initiative; I always look on the bright side.</td>
<td>3.76</td>
<td>1.308</td>
</tr>
<tr>
<td>Intrapersonal 3 (Sel3) I show understanding and appreciation to others; I always reflect on what I have done.</td>
<td>3.55</td>
<td>1.320</td>
</tr>
<tr>
<td>Interpersonal 1 (Soc1) I am kind, friendly, loving, caring, and considerate.</td>
<td>3.94</td>
<td>1.318</td>
</tr>
<tr>
<td>Interpersonal 2 (Soc2) I listen attentively, recognize others’ emotions, and respect their feelings.</td>
<td>3.63</td>
<td>1.422</td>
</tr>
<tr>
<td>Interpersonal 3 (Soc3) I like to make friends and get along well with others.</td>
<td>4.02</td>
<td>1.351</td>
</tr>
<tr>
<td>Naturalist 1 (Nat1) I derive a lot of pleasure just from looking at natural phenomena like clouds, trees, mountains, or other formations.</td>
<td>3.74</td>
<td>1.294</td>
</tr>
<tr>
<td>Naturalist 2 (Nat2) I have a hobby that involves nature in some way.</td>
<td>3.30</td>
<td>1.383</td>
</tr>
<tr>
<td>Naturalist 3 (Nat3) I love to watch birds or other animals and to follow their habits and find out other things about them.</td>
<td>3.58</td>
<td>1.439</td>
</tr>
</tbody>
</table>

A Cronbach’s alpha reliability test = 0.8 for these 21-items
structure within this four subscale factor model. Some of the items from the original seven subscales (musical, logical-mathematical and naturalist), as suggested by Gardner, do not appear in the same factor groupings. For example, three items that measure the self-rating of mathematical intelligence are found in three separate factors. This, at least from a Western perspective, does not seem to fit theoretically.

To provide further support for the four-factor model, we conducted a series of confirmatory factor analyses based on the factor structure uncovered in exploratory factor analysis as shown in Table 3. Confirmatory factor analyses were conducted on the total sample using the STATA package. A range of fit and comparison-based indices, including chi-square, was used to determine whether the variance of the intelligence model fitted these Africa data (Bentler, 1989; Browne & Cudeck, 1993; Steiger, 1990). The fit indices are shown in Table 4 and include Root Mean Square Error of Approximation

<table>
<thead>
<tr>
<th>Factor solutions</th>
<th>Chi-squares</th>
<th>p</th>
<th>Variance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-factor solution</td>
<td>$\chi^2(189) = 828.122$</td>
<td>$p&lt;0.001$</td>
<td>22</td>
</tr>
<tr>
<td>2-factor solution</td>
<td>$\chi^2(169) = 438.707$</td>
<td>$p&lt;0.001$</td>
<td>29</td>
</tr>
<tr>
<td>3-factor solution</td>
<td>$\chi^2(150) = 318.253$</td>
<td>$p&lt;0.001$</td>
<td>35</td>
</tr>
<tr>
<td>4-factor solution</td>
<td>$\chi^2(132) = 236.261$</td>
<td>$p&lt;0.001$</td>
<td>40</td>
</tr>
<tr>
<td>5-factor solution</td>
<td>$\chi^2(115) = 168.376$</td>
<td>$p&lt;0.01$</td>
<td>44</td>
</tr>
<tr>
<td>6-factor solution</td>
<td>$\chi^2(99) = 130.698$</td>
<td>$p&lt;0.05$</td>
<td>49</td>
</tr>
<tr>
<td>7-factor solution</td>
<td>$\chi^2(84) = 82.360$</td>
<td>$p&gt;0.05$</td>
<td>53</td>
</tr>
</tbody>
</table>

Figure 1. Scree test of eigenvalues.
(RMSEA), Standardised Root Mean Square Residual (S-RMR), Coefficient of Determination (CD), Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI). Hu and Bentler (1999) suggest various cut-offs for these fit indices. To minimise Type I and Type II errors one should use a combination with S-RMR or the RMSEA. In general good models should have an S-RMR < 0.08 or the RMSEA < 0.06 with the fit index values > 0.9. According to Brown (2006) a range of CFI and TLI of 0.9 and 0.95 may indicate acceptable fit if other fit measures provide evidence of a good model fit. Regarding the RMSEA Brown states that a close fit is indicated by values less than 0.05 and an acceptable fit between 0.05 and 0.08. Summary of tests for invariance of the structure of four multiple intelligences are shown in Table 4. Model 2 shows the best fit with RMSEA and S-RMR < 0.06 and the CD, TLI and CFI > 0.9.

It can be seen from Table 5 that the data fit the four factor model moderately well and that there are correlations among the dimensions. The most highly correlated dimensions were L1 and L2 (r=0.78).

Higher order factor solutions of perceived four intelligences. It was decided to investigate a second order factor model owing to the correlation of the latent constructs, L1 and L2. Table 6 shows a relatively good fit for the model and Figure 2 presents the hypothesised one-second order factor model visually. Two of the four proposed latent factors—L1 and L2—appear to be included under the one second order factor labelled H1. H1 has correlations with L3 and L4 of 0.81 and 0.71 respectively.

Table 3. Promax-rotated four-factor pattern matrix solution.

<table>
<thead>
<tr>
<th></th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lin1</td>
<td>28</td>
<td></td>
<td></td>
<td>(27)</td>
</tr>
<tr>
<td>Lin2</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lin3</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mus1</td>
<td></td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mus2</td>
<td></td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mus3</td>
<td></td>
<td></td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Mat1</td>
<td></td>
<td></td>
<td></td>
<td>37</td>
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<tr>
<td>Mat2</td>
<td></td>
<td></td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>Mat3</td>
<td>55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spa1</td>
<td></td>
<td></td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Spa2</td>
<td></td>
<td>26</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Spa3</td>
<td></td>
<td></td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Sel1</td>
<td></td>
<td></td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>Sel2</td>
<td></td>
<td></td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>Sel3</td>
<td></td>
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<td>29</td>
</tr>
<tr>
<td>Soc1</td>
<td></td>
<td></td>
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<td>Soc2</td>
<td></td>
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<td>Soc3</td>
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<td>Nat1</td>
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<td>43</td>
</tr>
<tr>
<td>Nat3</td>
<td></td>
<td></td>
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<td>43</td>
</tr>
</tbody>
</table>

Extraction Method: Maximum Likelihood, Rotation Method: Promax with Kaiser Normalisation. Rotation converged in 6 iterations. Kaiser-Meyer-Olkin Measure of Sampling Adequacy 0.906, Bartlett’s Test of Sphericity chi-square 5547.455, df 210, sig .000, Goodness of fit chi-square 236.261, df 132, sig .000; Note: Only loadings of magnitude above 0.22 are shown. Bracketed terms are not included in future CFA model. Decimals in factor loadings are omitted.
Table 4. Summary of tests for invariance of the structure of Four-Factor models using confirmatory factor analysis.

<table>
<thead>
<tr>
<th>Competing Model</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>RMSEA</th>
<th>S-RMR</th>
<th>CD</th>
<th>TLI</th>
<th>CFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1: Four-Factor Model with no covariance</td>
<td>2017.92</td>
<td>189</td>
<td>0.073</td>
<td>0.125</td>
<td>0.969</td>
<td>0.628</td>
<td>0.665</td>
</tr>
<tr>
<td>Model 2: Four-Factor Model with pattern of factor loadings held invariant</td>
<td>610.72</td>
<td>183</td>
<td>0.036</td>
<td>0.034</td>
<td>0.950</td>
<td>0.910</td>
<td>0.922</td>
</tr>
<tr>
<td>Model 3: Four-Factor Model with pattern of factor loading, factor variances and covariances held invariant</td>
<td>756.84</td>
<td>189</td>
<td>0.041</td>
<td>0.055</td>
<td>0.948</td>
<td>0.884</td>
<td>0.896</td>
</tr>
</tbody>
</table>

Table 5. Common metric completely standardised solution for Model 2: Four-Factor model.

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Lin1 Verbose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>Mat2 Collects, compares, sorts</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td>Mus3 Plays instruments</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L4</td>
<td>Mus1 Sings, hums, whistles</td>
<td></td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spa1 Remembers landmarks</td>
<td></td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Factor correlation</td>
<td>L1</td>
<td>L2</td>
<td>L3</td>
<td>L4</td>
</tr>
<tr>
<td>Factor correlation</td>
<td></td>
<td>78</td>
<td>59</td>
<td>45</td>
</tr>
</tbody>
</table>

What insights could be given, if any to interpret the children's self-perception groupings given their school experiences and culture?

Relationship between the SMIP items and student test outcomes. In addition to the data around SMIP, student outcomes had also been gathered for these students on mathematics, English
reading and Kiswahili tests. The reading test used was the ‘Single Word Reading Test’ (National Foundation for Educational Research) and the mathematics test was made up of items taken from GMADE 1 to 4 (Pearson). In order to address issues around cross-cultural transportability of tests, pilots were carried out in Morogoro schools, west of Dar Es Salaam. Teachers and educationalists in Nairobi devised the Kiswahili test. For all of the tests changes were made after the pilot through discussions and in collaboration with local teachers.4

The analyses above regarding the EFA highlighted a lack of simple structure for the SMIP, within the seven multiple intelligences subscales as suggested by Gardner. Looking at how the children's test scores correlate with specific items may provide some explanation. Three of the self perception questions are given in each of the areas of verbal and mathematical intelligences. These are shown in Table 7, along with their correlations with children's test scores.

Lin1 'I enjoy talking and playing with words', Mat1 'I actively search for patterns, cause-effect and logical relationships', and Mat2 'I collect, categorise, study and analyse things' are not correlated to the areas of study that the multiple intelligence item purportedly links. The items Lin1 and Mat3 are not significantly correlated with any test; Mat1 is negatively significantly correlated to both Kiswahili and mathematics. A possible explanation is considered in the discussion below.

**Children's self-perception groupings and cultural beliefs.** Shavelson, Hubner & Stanton (1976) in their review of existing literature and instruments utilised to measure self-concept state that:

Table 7. Test outcome correlations with SMIP items.

<table>
<thead>
<tr>
<th>Item</th>
<th>Question</th>
<th>EFA coefficient</th>
<th>English reading</th>
<th>Kiswahili</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lin1</td>
<td>I enjoy talking and playing with words.</td>
<td>0.28</td>
<td>-0.045</td>
<td>-0.019</td>
<td>-0.016</td>
</tr>
<tr>
<td>Lin2</td>
<td>I enjoy writing; I am fluent and expressive.</td>
<td>0.44</td>
<td>0.045</td>
<td>0.048*</td>
<td>0.040</td>
</tr>
<tr>
<td>Lin3</td>
<td>I read a lot for pleasure and information.</td>
<td>0.42</td>
<td>0.042</td>
<td>0.085**</td>
<td>0.088**</td>
</tr>
<tr>
<td>Mat1</td>
<td>I actively search for patterns, cause-effect, and logical relationships.</td>
<td>0.37</td>
<td>-0.034</td>
<td>-0.053*</td>
<td>-0.054*</td>
</tr>
<tr>
<td>Mat2</td>
<td>I collect, categorise, study and analyse things.</td>
<td>0.31</td>
<td>-0.004</td>
<td>0.036</td>
<td>0.041</td>
</tr>
<tr>
<td>Mat3</td>
<td>I play with numbers; I enjoy arithmetic 'problems'.</td>
<td>0.55</td>
<td>0.039</td>
<td>0.092**</td>
<td>0.135**</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level.**

*Correlation is significant at the 0.05 level.*
Figure 2. One-second-order factor model of perceived multiple intelligences (new model).
In very broad terms, self-concept is a person's perception of himself. These perceptions are formed through his experience with his environment, and are influenced especially by environmental reinforcements and significant others. (p. 411)

Our data suggest that we would agree. Indeed, through the multi-dimensionality of the project, household data were collected from a sample of parents who were asked to explain their understanding of intelligence. Typical of the responses were:

• ‘Is innovative and creative and is inquisitively curious to know more’;
• ‘the talented student child has personal capacity’;
• ‘they make wise decisions’;
• ‘the child who is curious and creative’;
• ‘the child who is doing the right thing’.

The words ‘curious’, ‘wise’, ‘inquisitive’, and ‘do the right thing’ (trustworthiness) all comply with findings around cultural concepts of intelligences in Africa. Our four-factor model solution (Table 5) as determined by CFA reveals a factor structure that could be interpreted as being consistent with African cultural beliefs. The ideas around cultural and environmental influences are taken further in the discussion below.

Discussion

This paper set out to investigate two areas of interest. First, to consider the structural representation of the self-perceived multiple intelligences for these 1,829 children using the SMIP, and second, once the best fit model was found, to discuss possible influences regarding the children's self-perceptions given their school experiences and culture.

Campbell et al. (2004) classified Gardner’s eight intelligences into three clusters—personal related, object related, and object free intelligences. Others in African settings have found that the concepts of intelligence are based around what is socially meaningful (Mpofu et al., 2012). What is regarded as beneficial for the community is often viewed as intelligence, not a ‘set of cognitive abilities as highlighted by Western concepts’ (Mpofu et al., 2012, p. 4). The Chewas of Zambia divided intelligence into four indigenous constructs— wisdom, aptitude, responsibility and trustworthiness—which could then be represented by two aspects—cognitive and social (Serpell, 1977, 1993). The same two aspects were found to be concepts of intelligence for the Luo of Kenya (Grigorenko et al., 2001). In our research a four factor first order model was shown to have a good fit. The items making up each of the four factors are shown in Table 5. The combination of items within the first factor (L1) may not be surprising in an African setting as social propinquity and the social timeliness with which a child responds to collective needs with others is a valued cultural behaviour in sub-Saharan culture (Mpofu, et al., 2012; Serpell, 2011a, b). The second factor (L2) contains items that could infer the ability to be curious about nature and/or interacting with one’s environment and the community. The combination of items in this factor highlights the awareness of self and others, and awareness of nature and environment. In some African countries such as Uganda and Zimbabwe, intelligence is viewed as a social construct built on local, social and environmental conditions (Grigorenko et al., 2001; Mpofu et al., 2012; Sternberg et al., 2001). The third factor (L3) puts together items that suggest creativity, inquisitiveness, aptitude and curiosity. The Chewa of Zambia indeed regard aptitude and wisdom as two of the indigenous intelligence constructs (Serpell, 1977, 1993). The fourth factor (L4) is more difficult to define, made up of
musical and one dominant visual spatial item. The one factor second order model (as shown in Figure 2) highlights an overall awareness intelligence having correlation with the L1 and L2. This could lead us to postulate that the findings broadly agree with the literature that intelligence in sub-Saharan Africa is regarded essentially as a social construct, and is socially oriented behaviour that benefits a collective society (Dasen, 2011; Grigorenko et al., 2001; Irvine, 1970, 1988; Mpofu et al., 2012; Wober, 1974).

The pedagogical approach of teaching in sub-Saharan African schools is typically by rote. According to Gardner (1999) an education system that teaches and assesses children utilising one method is ‘unfair’. Such a strategy would only work if everyone had the same mind and one kind of intelligence. Gardner has suggested teachers should consider using different teaching strategies so students can learn through their own individual strengths. Although schools cannot teach intelligence they can develop intelligences. Gardner provides the example of the Suzuki violin method where the child who ‘is devoting many hours each week to a single kind of pursuit and to the development of a single intelligence’ is doing so ‘at the cost of stimulating and developing other intellectual streams’ (p. 396). The MI theory has important implications for classroom instruction and procedures, which in turn impact on the facilitation and development of the full spectrum of students’ intelligences (Zhang & Chan, 2010). In order to provide children with more opportunities to learn through their strengths, Gardner developed the entry point approach suggesting seven entry points aligned to different intelligences. An entry point puts the child directly at the centre of a topic, stimulating their interests and therefore further exploration (Zhang & Chan, 2010). Children in a Tanzanian classroom are never asked to voice their own opinions or think for themselves but just regurgitate information provided by the teacher.

The children’s mathematics experience in school would be focused on number only. The memorisation of answers and algorithms that can be recalled during tests and examinations make up mathematics lessons. In language classes, texts will be rote learnt and answers to comprehension memorised. This could bring problems regarding the SMIP items within both the verbal linguistic and logical mathematical intelligences. The concept that mathematics is about collecting and categorising, exploring patterns and looking for relationships, as well as logical reasoning and critical thinking are notions that these children will never have experienced. The opportunity to write creatively or discuss ideas or thoughts never occurs in class. Thus, one possible reason for the low correlations within these subscales is the disassociation between the item and the children’s experiences around these subjects in school. The children may link their abilities to contexts without generalising them to their own personal qualities (Grigorenko et al., 2001; Mpofu, Myambo, Mogaji, Mashego & Khaleefa, 2006; Serpell, 2011a, b; Sternberg et al., 2001). Another possible reason for the low correlations is that the schools are not developing the children’s intelligences. Assessment results not only illustrate how children understand or perform but may also reflect the quality of the current instruction (Zhang & Chan, 2010).

Future studies could consider qualitative inquiry to unravel how these learners interpret this abstraction task. Findings could inform the design or selection of a more credible abstraction task for the Kiswahili speaking learners. In order to consider the structure of perceived multiple intelligences in African settings it may be beneficial to use indigenous tasks for assessing and providing further insight into the structure of multiple intelligences. When using self-concept measures in different cultural contexts it is important to note the influences of environmental reinforcements.
Notes

1. Verbal-linguistic, musical, logical mathematical, visual spatial, bodily kinaesthetic and naturalist.
2. Intra-personal and inter-personal.
3. Findings reported elsewhere.
4. Cronbach’s Alpha for each of the tests >0.8.

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