INTERNATIONAL JOURNAL OF DISABILITY, DEVELOPMENT AND EDUCATION
https://doi.org/10.1080/1034912X.2024.2403390

PEDS Developmental Screening Tool Construct Validity for Northern Sotho and Zulu Versions: A Validation Study

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ABSTRACT

Validation of the translated PEDS test is necessary to improve early detection of developmental delays. This study aimed to determine the construct validity of the translated Northern Sotho and Zulu PEDS tests. This validation study determined whether the translated PEDS tests are valid when compared to the reference English PEDS test. Stratified convenience sampling was used to recruit a collective of 546 research participants from a government healthcare facility in South Africa. A higher referral rate (43%) was found for Zulu participants when compared to Northern Sotho participants (17%). There were significant correlations of the Zulu and Northern Sotho PEDS tests when compared to the reference English PEDS test. Pearson correlations for the Zulu PEDS test ranged from 0.815 (very strong association) to 1.000 (perfect association) and for Northern Sotho from 0.496 to 0.854 (both, very strong association). Equivalence percentages for the Zulu PEDS ranged from 90.9% to 100.0% and for the Northern Sotho PEDS from 92.3% to 100.0%. The translated PEDS test has been found to have construct validity.

ARTICLE HISTORY
Received 4 November 2021
Accepted 27 August 2024

KEYWORDS
Construct validity; developmental screening; developmental milestones; PEDS test; translation; childhood development

Introduction

Early childhood development, including speech-language, cognitive, motor and social-emotional domains, is associated with appropriate adult health and functioning. Children who receive adequate stimulation, which results in age-appropriate development, have better chances of becoming contributing members of society (Tran et al., 2019; Zablotsky et al., 2019). Adults with a history of developmental delays and disorders, who did not receive early intervention services, may not be able to significantly contribute to the economy and are more likely to be dependent on social services for food supplies, healthcare and rehabilitation (Lunsky et al., 2019). Almost 43% of the children under 5 years of age in low- or middle-income countries (LMICs), are at risk of failing to reach their developmental potential (Tran et al., 2019). As a result, interventions targeting early childhood development should be prioritised (Tran et al., 2019). Globally, a renewed

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focus is placed on early childhood development through the United Nations Sustainable Development Goal of ensuring inclusive and equitable quality education and to further promote lifelong learning opportunities to improve outcomes (United nations, n.d.).

Developmental screening is an evidence-based early intervention method that aids the identification of children who are at risk of a developmental delay (Barger et al., 2018). A well-validated developmental screening tool is essential to ensure young children are identified as early as possible (Faruk et al., 2020). Standardised developmental screening tools, which are effective in high-income countries, may also be beneficial for use in LMICs (Faruk et al., 2020). However, there are challenges regarding the feasibility of its use in resource-constrained settings in LMICs including the limited cultural and linguistic relevance of these tools (Faruk et al., 2020; Gladstone et al., 2008). The cultural and linguistic relevance of developmental screening tools may be improved by translating these tools into different languages for different ethnic and cultural settings and subsequently validating them (Faruk et al., 2020).

Parent-administered tools are often preferred rather than clinician-administered tools in LMICs due to the shortage of healthcare workers (Garg et al., 2018). Two parent-administered developmental screening tools being the Ages and Stages Questionnaire and the Parents' Evaluation of Developmental Status (PEDS) have been widely recommended for use in LMIC as they are both applicable in primary healthcare settings (Faruk et al., 2020). Caregiver completed tools allow more children to be reached through developmental screening and in turn improve access to early intervention services (Maleka et al., 2016). The PEDS test has been translated into 57 languages globally, and it is deemed a valid tool in many countries, including South Africa (PEDS test, 2012; Yoldas et al., 2020).

In South Africa, the PEDS test has been translated into two dominant South African languages, namely Northern Sotho and Zulu. These translations were found to be appropriate for use in the South African setting (Van der Merwe et al., 2017). South Africa is a diversely populated country with 11 official languages, therefore, a need to conduct developmental screening in indigenous South African languages is clear (Deumert, 2010). The PEDS test has been recommended for use in South Africa due to its affordability and since it does not require additional materials (Maleka et al., 2016). The PEDS test has been widely validated and consists of questions regarding caregiver concerns on the different developmental domains (e.g. fine motor and gross motor; expressive and receptive language) (Glascoe, 2013).

Adapting and/or translating measures serves to enhance fairness in assessment (thereby minimising bias and increasing the validity of the responses), reduce costs, save time, as well as facilitate comparative studies between different cultural and language groups within a given context (Kanjee, 2019). Of course, there are many concerns when translating tests with Osterlind et al. (2004) stating that 'the primary concern is that the instrument's construct validity is adequately and appropriately maintained across test versions. Only with accurate and meaningful translation can consistent score interpretations be made. This is the essence of validity' (p. 62). Establishing construct validity of translated instruments has been considered by many researchers using a variety of approaches over the last few decades; see for example, Alhanbali et al. (2022), Barreto et al. (2016), Li et al. (2019), Shibaoka et al. (2010) and Wigler et al. (1999). There are many different ways to establish the construct validity of translated instruments, for example,

some researchers used factor analysis (Alhanbali et al., 2022; Li et al., 2019), whereas others used correlations (Barreto et al., 2016; Shibaoka et al., 2010; Wigler et al., 1999). Factor analysis could not be conducted in the current study as the PEDS questionnaire consists of 10 questions with response options 'yes', 'no' and 'a little' that parents answer that aim to capture different developmental domains, i.e. it is one item/question per domain which does not lend itself to factor analysis. Accordingly, in the current study, we used correlations to establish the constructed validity. For construct validity, an instrument and its translated version(s) should be highly correlated when data are collected at the same (or approximately the same) timepoint, i.e. there is not a significant time-frame between the two measurements to have changed to the outcome of what is measured. Thus, construct validity is established by correlating results between two measurements/tests where, in this study, the results of the Zulu and Northern Sotho PEDS tests are correlated with those of a previously established measurement, the English PEDS test. By determining the construct validity of the Zulu and Northern Sotho PEDS tests, they yield meaningful, accurate and justifiable inferences of the applicability of the developmental screening tool. Most parent-administered test questions are based on observed child behaviour. Therefore, a clear rationale is evident for the cultural adaptation of instruments (Hyman et al., 2020).

The absence of validated instruments in indigenous languages has prevented the assessment and early identification of some children who require early intervention services. It has thus been recommended from previous studies that the translated PEDS test in indigenous languages be evaluated in various contexts and on a larger scale, to determine construct validity (Fyvie et al., 2016; Van der Merwe et al., 2017). The primary research question (PRQ) is: How does the translated Northern Sotho and Zulu PEDS tests perform against the validated English instrument? The PRQ is supported by the secondary research questions (SRQs): SRQ1: How do younger and older participants compare when considering all the PEDS versions? SRQ2: How do the outcomes of all the PEDS versions compare in terms of age and gender of the participants?

Materials and Methods

Research Design

A prospective research design was implemented to compare the outcomes of the Zulu and Northern Sotho versions of the PEDS test against the reference English version. The study was conducted in the South African primary healthcare setting with caregivers of children from an urban and a peri-urban area. The comparison was done to determine whether the Zulu and Northern Sotho PEDS tests are valid when compared to the reference English PEDS test. The current study aims to establish the construct validity of the two translated versions of the PEDS test in the South African context.

Setting

A government regional secondary healthcare facility located in Eastern Johannesburg, South Africa, was utilised to collect data. The region is characterised by high inter-nodal traffic volumes providing transport and other services to residents in surrounding areas

(Nicholson, 2001). The hospital itself receives self-referrals and referrals from neighbouring primary healthcare clinics. The dominant languages spoken in this area are English, Zulu and Northern Sotho (Nicholson, 2001).

Sampling

Stratified convenience sampling was used to recruit 546 research participants. All the participants were black ($n = 313$; 100%) and the majority were female ($n = 178$; 56.9%) in the Northern Sotho group, in the Zulu group the majority were black ($n = 229$; 98%) and also female ($n = 128$; 54.9%). There were more participants in the younger age range of 0 months–3 years ($n = 149$; 63.9%) 2 months compared to the older age group of 3 years 3 months–7 years 11 months for the Zulu group. In the Northern Sotho group, there were also more participants in the younger age group ($n = 191$; 61%).

Data Collection Material

The PEDS test consists of 10 questions regarding a child's general development (PEDS test, 2012). The PEDS test has been translated into Zulu and Northern Sotho (Fyvie et al., 2016; Van der Merwe et al., 2017).

The responses to the PEDS test were interpreted using the PEDS interpretation form, which explains the five evidence-based pathways of referrals. The first pathway, A, constitutes two or more predictive concerns and requires referral to an allied health care professional. Pathway B is followed when one predictive health concern is indicated. The child should be screened for health or sensory problems, and a second developmental screen can be considered. Pathway C includes non-predictive concerns and counselling should be provided in areas of difficulty. Follow-up screening is required. Pathway D should be followed when parents have difficulty in communicating their concerns. A second screen that directly elicits the child's skills can be conducted. Pathway E indicates no parental concerns, and the child is perceived as typically developing; thus, it is a low-risk path. Pathways A–D are interpreted as 'failing the screening', and pathway E is considered a pass (Glascoe, 2013). In addition, a language preference questionnaire was administered to determine the participants' preferred language.

Data Collection Procedures

Ethical clearance was obtained from the Research and Ethics Committee of the Faculty of Health Sciences, University of Pretoria (HUM023/0119) before the commencement of the study. Written informed consent was also obtained, and thereafter, demographic questions were asked. The administration of the English, Northern Sotho or Zulu PEDS test, depending on the parent's/caregiver's preferred language was conducted. The researcher randomised the English PEDS and the Northern Sotho or Zulu PEDS test to compensate for a learning effect. A language preference questionnaire was completed by the parents/caregivers. Based on the outcomes of the reference English PEDS test, a second screen was done using the Parents Evaluation Developmental Status: Developmental Milestone (PEDS: DM). Thereafter, if a refer result was obtained, referral letters were provided to

parents/caregivers whose children failed the screening for the attention of the relevant healthcare professionals to provide early intervention.

Statistical Analysis

Descriptive statistics were used to analyse biographical information. The Chi-square (χ^2) test was used to test for differences between two independent groups (e.g. male vs female). Studies on construct validity typically makes use of correlation coefficients to establish construct validity (Barreto et al., 2016; Shibaoka et al., 2010; Wigler et al., 1999). There are many different recommendations in the literature on how to interpret correlations, however, the Pearson correlation for binary variables is suitable for this study; since the data is binary, normality was not tested for and, in addition, the Pearson correlation is similar to the Phi coefficient as the data under consideration is binary and, accordingly, the general guidelines for interpreting the value of the Phi coefficient were followed as the recommendations for interpreting Phi does not vary as much in the literature on the recommendations for correlation; >0 (no or very weak), >0.05 (weak), >0.10 (moderate), >0.15 (strong) and >0.25 (very strong) (Akoglu, 2018). The equivalence of the Zulu and Northern Sotho PEDS tests with the English test were measured, respectively, considering the percentage pass and the percentage refer that was equivalent. For significant results, it is common to report on effect sizes and it should be noted that the Phi coefficient is a commonly used measure of effect size with recommendations being that 0.1, 0.3 and 0.5 denote small, medium and large effect size, respectively (Cohen, 1988). It should be noted that effect size is considered together with p-values when reporting on construct validity in Table 2, since a p-value may show statistical significance ($p < 0.05$), but the effect size (if small ($\leq$0.1)) may indicate that there is no real-life or practical significance (Baicus & Caraiola, 2009; Peeters, 2016). Thus, when establishing construct validity, it is important to check that $p < 0.05$, but also that effect size >0.1 (Goodman et al., 2019).

Results

Table 1 shows the Zulu and Northern Sotho PEDS test referral rates and the referral rates were significantly lower ($\chi^2(1) = 44.703$, $p < 0.001$) for the Northern Sotho population ($n = 52$; 17%) in comparison to the Zulu cohort ($n = 99$; 42%). Table 1 also provides a breakdown between younger and older participants (to address SRQ1) and by male and female (to SRQ2 2). For SRQ1 'How do younger and older participants compare

Table 1. Zulu ($n = 233$) and Northern Sotho ($n = 313$) PEDS test referral rates.

	Zulu PEDS 100 (43%)	*English PEDS 99 (42%)	Northern Sotho PEDS 72 (23%)	**English PEDS 52 (17%)
Age				
0 months–3 years 2 months	67 (67.0%)	67 (67.6%)	40 (55.5%)	27 (51.9%)
3 years 3 months– 7 years 11 months	33 (33.0%)	32 (32.3%)	32 (44.4%)	25 (48.0%)
Gender				
Male	39 (39.0%)	39 (39.3%)	31 (43.0%)	24 (46.1%)
Female	61 (61.0%)	60 (60.6%)	41 (56.9%)	28 (53.8%

*Reference English PEDS test administered with the Zulu PEDS test.
**Reference English PEDS test administered with the Northern Sotho PEDS test.

Table 2. Equivalence percentages and correlations between the translated tools and the reference English PEDS test per domain-specific outcomes.

	Zulu/English		Northern Sotho/English	
Developmental domain/Question	Equivalence % (refer, pass)	[3]*r*	Equivalence % (refer, pass)	*r*
[1]Global/cognitive Q1	100.0%; 99.5%	0.964	100.0%; 93.8%	0.503
Expressive language and articulation	100.0%; 99.6%	0.815	100.0%; 94.7%	0.621
Receptive language	100.0%; 99.5%	0.966	100.0%; 95.1%	0.597
Fine motor	100.0%; 100.0%	1.000	100.0%; 96.0%	0.707
Gross motor	100.0%; 99.5%	0.964	100.0%; 96.0%	0.730
Behaviour	99.5%; 100.0%	0.970	100.0%; 95.9%	0.750
Social-emotional	97.6%; 100.0%	0.985	100.0%; 96.5%	0.854
Self-help	90.9%; 99.5%	0.923	94.9%; 100.0%	0.728
School	100.0%; 100.0%	1.000	94.3%; 100.0%	0.687
[2]Global/cognitive Q10	100.0%; 100.0%	1.000	100.0%; 94.4%	0.496
PEDS Path	100.0%; 99.3%	0.991	100.0%; 92.3%	0.817

[1]An open-ended question asked at the beginning of the PEDS test.
[2]An open-ended question asked at the end of the PEDS test.
[3]All p-values were statistically significant (all $p < 0.001$) and not show in Table 2 for conciseness.

when considering all the PEDS versions?', Table 1 shows a higher referral rate in the younger age range of 0 months–3 years 2 months compared to the older age group of 3 years 3 months–7 years 11 months for all the PEDS tests versions. For SRQ2: 'How do the outcomes of all the PEDS versions compare in terms of age and gender of the participants?', Table 1 shows a higher referral rate for female children when compared to males for all versions of the PEDS test. However, the differences in referral rates between the two age groups (SRQ1) and between the two genders (SRQ2) across all the versions of the PEDS test were not statistically significant (χ^2 test).

To address the PRQ 'How does the translated Northern Sotho and Zulu PEDS test perform against the validated English instrument?', the level of agreement of the Zulu and Northern Sotho PEDS test against the reference English test was evaluated with Pearson's correlation coefficient (*r*), (or, equivalence, Phi's coefficient (φ)) values (Table 2); for brevity we use only *r* from this point forward.

The Zulu PEDS test indicated that, the expressive language and articulation developmental domain obtained the lowest correlation (0.815), however, since it is above 0.25, it still indicates a very strong correlation (Table 2). In fact, all correlations for the Zulu PEDS test were indicative of an almost perfect correlation, and fine motor, school and global/cognitive (Q10) indicated perfect correlation between the reference English and Zulu PEDS test. The Northern Sotho PEDS test, the global/cognitive Question (Q) 10 developmental domain showed the lowest correlation (0.496), however, since it is above 0.25, it still indicates a very strong correlation. All other developmental domains indicated very strong correlations, however, none showed perfect correlation (Table 2). The equivalence (percentage pass and the percentage refer that were equivalent) was computed. The Zulu group, 219/233 participants passed the reference English PEDS test and furthermore, 218/233 (99.5%) passed the Zulu PEDS test and of the 14 that were referred by the reference English test, all 14 (100.0%) were referred by the Zulu test. Since all the Phi coefficients/correlations are greater than 0.3 in Table 2, all effect sizes are large.

The Northern Sotho ($n = 265$; 84.7%) and Zulu ($n = 175$; 75.1%) languages were the preferred PEDS testing language when compared to English.

Discussion

The referral rate in the Northern Sotho group was statistically lower ($n = 52$; 17%) than the Zulu ($n = 99$; 42%) group's referral rate. The Zulu group's high PEDS test referral rate corresponds with previous Zulu PEDS test studies whereby referral rates of 50% and 66% were found (Maleka et al., 2019; Van der Merwe et al., 2017). Higher referral rates are typical in environments where children are at a high risk of developmental delays due to poverty, maternal psychosocial risks, lifetime intimate partner violence and history of maternal childhood trauma (Maleka et al., 2016; Van der Linde et al., 2015). The significantly lower Northern Sotho referral rate was also lower than previous studies amongst Northern Sotho participants (46%) in South Africa (Fyvie et al., 2016; Maleka et al., 2019). The inconsistencies in referral rates could be due to sampling bias which resulted from using convenience sampling. There could have been under representation of subgroups in the sample in comparison to the population of interest (Andrade, 2021). It is therefore recommended that for future research randomised sampling be used in a similar context to establish referral rates. Although the differences in referral rates were not statistically different between age groups, the higher referral rates found among younger children were also found in other South African studies as well as in rural Pakistan whereby a cohort of younger obtained a higher referral rate when compared to older children (Saleem et al., 2021; Van der Berg et al., 2010).

The Zulu PEDS test significantly correlated with the English reference PEDS test with correlations between developmental domains ranging from substantial ($r = 0.815$) to perfect correlation ($r = 1.000$) (Milbrath et al., 2020). The Northern Sotho PEDS test was also found to be in agreement with the English reference PEDS test with correlations ranging from fair agreement ($r = 0.496$) to very strong ($r = 0.854$) (Milbrath et al., 2020). Translated PEDS tests with demonstrated construct validity may be used for developmental screening to effectively identify children who present with developmental delays (Barger et al., 2018; Glascoe, 2013). Similar findings were reported in previous studies where the translated Persian PEDS test was found to have a fair agreement ($\kappa = 0.30$ when compared to the reference English PEDS test (Vameghi et al., 2020).

The construct validity of both the Zulu and Northern Sotho PEDS tests were further evident as the Zulu PEDS test showed a referral equivalence of (100.0%) and a high pass equivalence of (99.3%) with the reference English version. Similarly, the Northern Sotho PEDS test demonstrated construct validity with high referral equivalence of (93.6%) and pass equivalence of (92.3%) with the reference English version. The Zulu and Northern Sotho PEDS tests are in strong association with the reference English PEDS test and construct valid and can therefore expand accessibility of developmental screening in South Africa (Van der Merwe et al., 2017). The 10 questions on the PEDS test which elicit parental concerns regarding children's overall developmental milestones have been adequately translated. Therefore, the valid Zulu and Northern Sotho translations among all the developmental domains means that children who are at risk of any developmental delay across the board will be correctly identified (Van der Merwe et al., 2017).

The PEDS translations demonstrated strong correlations between translations, as the translated PEDS test effectively associates with the reference English PEDS test. Therefore, accurate translations may be usable in the South African context, where the children are at high risk of developmental delays. Translated PEDS tests being equivalent with the

English PEDS test means that developmental delays from children of multiple linguistic backgrounds will be identifiable early and ultimately these children will be able to receive early intervention (Van der Merwe et al., 2017). An accurately translated PEDS test may increase accessibility to developmental screening services and further increase early assessment and early intervention of developmental delays (Van der Merwe et al., 2017). Reliability studies were not in the scope of this study and thus, it is recommended that reliability studies be conducted for future research.

Conclusion

The translated Zulu and Northern Sotho PEDS tests have both shown a significant correlation with the reference English PEDS test. Furthermore, these developmental screening tools have proven to have construct validity with significant agreement and strong association between the reference English PEDS test and the Zulu and Northern Sotho PEDS tests. The tools may be used in the South African population to increase accessibility to developmental screening services and ultimately early intervention.

Acknowledgments

The authors thank all the participants.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

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