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Interpreting evidence of differential item functioning (DIF) against learner responses: A South African example across three languages

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ABSTRACT

The current study presents the results for a specific subset of qualitative analyses that were done during Phase II of a larger, mixed-method study. In Phase I, the study aimed to find evidence of Differential Item Functioning (DIF) using a narrative passage ('The Pearl') that was used to test Grade 4 learners in English, Afrikaans and isiZulu during PIRLS Literacy 2016. In Phase II, a qualitative investigation followed into learner responses to items that presented with DIF in Phase I. Three out of 15 items from 'The Pearl' presented with DIF across the three languages. Qualitative findings pointed to Grade 4 learners' inability to respond to literal items, pointing to an inability to correctly answer those items that did not require any inference making or evaluation at higher-order levels of reading comprehension. Using Peña's (2007) translation equivalence for cross-cultural research framework to establish linguistic, cultural, functional and metric equivalence, the current study provides evidence that ´The Pearl´ presented no systematic item bias.

Keywords: differential item functioning, equivalence, item bias, large-scale assessments, PIRLS 2016, reading literacy

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1. Introduction

Reading comprehension is a vital skill, serving as the foundation for learning across all subjects. In 2016, South African Grade 4 learners participated in the Progress in International Reading Literacy Study (PIRLS), an international large-scale assessment (ILSA) involving more than 60 education systems to monitor trends in early reading literacy achievement. The South African results were concerning, as Grade 4 learners achieved the lowest reading scores among the participating countries (Howie et al., 2017). This poor performance in reading literacy has led scholars to explore various contributing factors, including differences among languages, background factors, environments, and the quality assurance procedures used during test development (Roux et al., 2022; Graham & Mtsweni, 2024; Pretorius & Stoffelsma, 2017; Spaull et al., 2020). However, there has been limited research on the translation equivalence of the different testing languages in PIRLS within the South African context.

This article presents the results of a specific subset of qualitative analyses conducted during Phase II of a larger mixed-method study. In Phase I, quantitative analyses provided evidence of DIF across an English, Afrikaans, and isiZulu Grade 4 narrative passage used in PIRLS Literacy 2016 (Roux, 2020). The study also focused on exploring learner responses to items that exhibited DIF, in an effort to identify patterns of systematic item bias.

2. Literature review

After the dawn of democracy in 1994, South Africa's social landscape transformed into a multi-lingual, multi-cultural and multi-ethnic society. Extensive political reform resulted in a Constitution which recognises eleven languages, as well as sign language, as official languages. As part of widespread political and educational reform, different policies such as the Language in Education Policy (LiEP) were drafted to transform the South African education system to one of equity and equality. According to Bergbauer, van Staden and Bosker (2016) the LiEP (Department of Education, Government gazette no. 18546, December 19, 1997) attempts to promote language equity and quality education in all official languages, with the aim to maintain home language(s), while providing access to the effective acquisition of additional languages. Therefore, the Department of Education follows an additive approach to promoting bilingualism from a mother tongue base. Despite these well-intentioned aims, the practical and effective implementation of this policy is difficult to achieve. Most learners in South Africa transition in Grade 3 from their home language as Language of Learning and Teaching (LoLT) to English or Afrikaans as LoLT in Grade 4 (Pretorius, 2014). This transition means that the LoLT is a second (or even third) language for more than 80.0% of learners who come from African languages backgrounds (Bergbauer et al., 2016).

Because of LiEP challenges, among others, disparities in literacy levels among South African Grade 4 learners exist. The PIRLS 2016 assessment served as a barometer for reading literacy skills on a global scale. With an achievement scale that ranges from 0 to 1000, and an international centre point of 500, overall achievement is usually interpreted as being significantly above or below this international centre point. In PIRLS 2016, learners from Russia obtained the highest reading literacy score (581 score points, Standard Error (SE)=2,2), followed by Singapore, which obtained a mean score close to the international centre point (576 score points, SE=3,2). To accommodate low achievement in PIRLS where mainly developing countries struggle with accurate reading estimates, PIRLS Literacy was developed as an easier assessment than PIRLS. Both PIRLS 2016 and PIRLS Literacy 2016 used the same assessment framework and processes of comprehension associated with each item that accompanies each reading passage. Overall, South Africa performed poorly on the PIRLS Literacy assessment (see Howie et al., 2017), with overall achievement at 320 score points (SE=4,4). More specifically, Grade 4 learners who completed the PIRLS Literacy 2016 assessment in English obtained the highest score (372 score points, SE=14,4), followed by Afrikaans (369 score points, SE=13,4). Grade 4 learners who were tested in Sesotho, IsiNdebele and SiSwati outperformed learners who were tested in isiZulu, who only managed to obtain 303 score points.

The question arises why isiZulu was chosen for the purposes of the current study. While learners who were tested in English and Afrikaans traditionally represent the best performing languages of testing in PIRLS in South Africa (see Howie et al., 2009; Howie et al., 2012; Howie et al., 2017a), a nationally representative sample of learners were tested in isiZulu as a way of gauging performance for the largest African language in South Africa. Last tested in PIRLS 2006, any growth in performance from PIRLS 2006 to PIRLS 2016 for learners who were tested in isiZulu would constitute a positive trend over a ten-year period.

Regardless of study design choices across cycles of PIRLS participation, the translation of the PIRLS reading passages was instrumental in accurately examining performance in the South African context. All the PIRLS 2016 assessment booklets were developed in US English, then adapted to South African English, which were then translated into the ten remaining official languages – including Afrikaans and isiZulu. Translation is the undertaking of linguistic discourse moving from one language (source language) to another language (target language) (Chan & So, 2017). Vottonen (2016) explains that translation could be seen as an encounter between the source language and the target language. Over the years, scholars have argued for the importance of having equivalent texts or content during the act of translation (see Bassnett, 2013; Nida, 1964). The translated content should be as close as possible to the source language. Therefore, it was important to consider the equivalence of the PIRLS passages across English, Afrikaans and isiZulu.

It is important to briefly describe the differences in terms of orthography between English, Afrikaans and isiZulu. African languages are agglutinative, meaning that the orthography for

these languages is long with complex word units. Orthographies like these mean that a root word may contain more than two or three morphemes. IsiZulu, as one of the Nguni languages, has a complex morphology (Keet & Khumalo, 2017) as it has a transparent and conjunctive orthography, which simply means that isiZulu has a "fairly straightforward one-tone relationship with the sounds they represent" (van Rooy & Pretorius, 2013, p. 282). In isiZulu, morphemes may occur as a prefix, infix or suffix to a stem and are written together as a single word unit (Trudell & Schroeder, 2007). Afrikaans also has a transparent orthography, while English has an opaque orthography. The differences between the two orthographies mean that the isiZulu words are longer with shorter and denser reading passages, but they require more time to read (Land, 2015).

3. Research questions

This study forms part of a larger, mixed-method study that sought to determine the extent to which a PIRLS Literacy 2016 passage presented with translation equivalence for South African Grade 4 learners who were tested in English, Afrikaans and isiZulu. While the PIRLS Literacy 2016 included passages called *'The Pearl'* and *'African Rhinos and the Oxpecker Birds'*, only results and analysis for *'The Pearl'* will be presented here as an example of the extent of translation equivalence of a narrative text. Children primarily read for two reasons: reading for literary experience and to acquire and use information (Mullis & Martin, 2015). For children to fully develop their reading skills, they need a variety of skills. One of these skills is being able to read for meaning (Duke & Carlisle, 2011; Roux, 2020). When children can not only read, but read for meaning, they can learn new things across the curriculum (Millin, 2015; Patterson et al., 2018).

The primary research question of the broader study asked:

> *To what extent are the PIRLS 2016 limited released passages in English, Afrikaans and isiZulu, in Grade 4 equivalent?*

To address the primary research question, two secondary research questions are posed:

1. *To what extent does 'The Pearl' present items that show Differential Item Functioning (DIF)?*
2. *How can evidence of DIF be explained against a random selection of learner responses to these items?*

4. Conceptual framework for the study

Peña (2007) identified four safety measures to guard against possible validity threats against cross-cultural assessments: linguistic, functional, cultural, and metric equivalences. Linguistic equivalence focuses on the translation of a piece of text or content and ensuring

that the source and translated versions are similar (Chesterman, 2016). Functional equivalence comprises the closest possible equivalence between the source and the target text after translation (Bermann & Porter, 2014). It is important to deliberate cultural equivalence since PIRLS is an ILSA where different cultures participate, meaning that the reading passage is understood in the same manner across the different cultures (Du Plessis et al., 2015). In terms of metric equivalence, it encompasses the item difficulty of international assessments (Peña, 2007).

Peña's (2007) four safety measures when conducting large, international cross-cultural research were considered for this study's conceptual framework (see Figure 1). Since this study forms part of a larger, mixed-methods study, it followed a pragmatic approach to ensure that both quantitative and qualitative methods were used to gain a more comprehensive understanding of the research problem (Morgan, 2014).

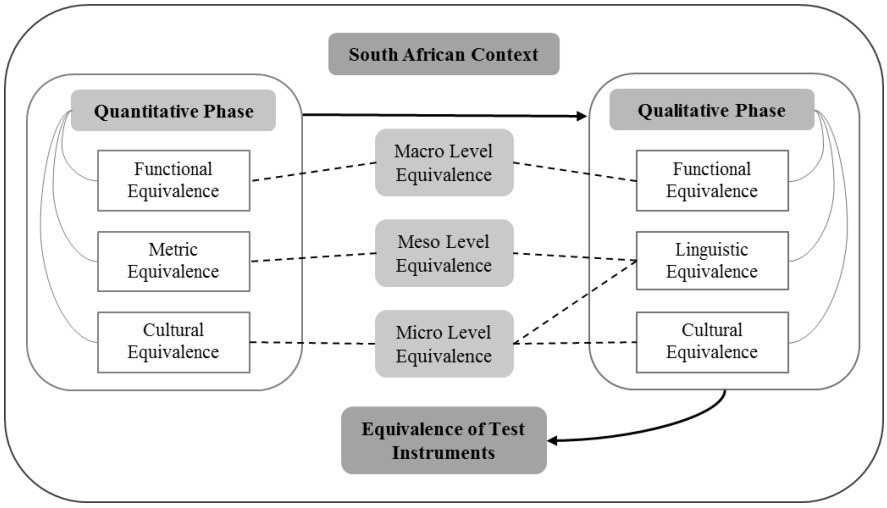

Figure 1: Translation equivalence for cross-cultural research (informed by Peña 2007)

Phase I (i.e. the quantitative phase of the study) drew from PIRLS Literacy 2016, where the overall score for South African Grade 4 learners was obtained, followed by the score per language (i.e., English, Afrikaans and isiZulu), additional descriptive statistics and Rasch measurement analysis. The results from Phase I instigated a deeper, qualitative investigation (Phase II) of the PIRLS Literacy 2016 results, specifically for those items from the reading passage that showed evidence of DIF. Based on DIF evidence in Phase I, the different equivalences (Peña, 2007) were considered for items across English, Afrikaans and IsiZulu in Phase II.

5. Research design and methods

The main purpose of the study was to determine if there was any evidence of DIF (i.e. measurement invariance) in the case of one reading passage for those learners who completed

it in English, Afrikaans and isiZulu. To do so, a secondary data analysis research design was selected as the data was already collected during the original study, PIRLS Literacy 2016.

5.1 Sampling and participants

This study is a secondary analysis of PIRLS Literacy 2016, specifically the South African Grade 4 data. The PIRLS Literacy 2016 study made use of a two-stage random sampling design. In the first stage, schools across the nine provinces were selected for participation and in the second stage, one or more classes were selected (La Roche et al., 2017). For the South African study, the sampling resulted in 293 schools, 324 classrooms, and 12 810 Grade 4 learners participating in PIRLS Literacy 2016 (Combrinck et al., 2017). Since the interest for this study was across three languages only, sampling reduction took place; only Grade 4 learners who completed the PIRLS Literacy 2016 assessment in English, Afrikaans or isiZulu were selected.

5.2 Data collection instruments and translations

The PIRLS Literacy 2016 consisted of two data collection instruments: the achievement booklets and the contextual questionnaires. For purposes of this study, the contextual questionnaires are irrelevant and the focus is on the reading passages contained within the achievement booklets. Each achievement booklet contained two texts or reading passages, one literary (narrative) and one informational (Mullis & Martin, 2015). Each passage was accompanied by 13 – 18 questions. For purposes of this study, '*The Pearl*' as a case of a narrative passage is analysed.

The PIRLS Literacy 2016 assessment followed strict guidelines and procedures to uphold validity and reliability to ensure comparative data were collected (see Mullis & Prendergast, 2017). As part of establishing rigorous validity and reliability standards, strict translation procedures were adhered to. The PIRLS National Research Coordinator (NRC) ensured that any changes made to the passages or items were recorded on the National Adaptation Forms (NAFs). As part of the quality assurance of the cross-cultural study, the International Association for the Evaluation of Educational Achievement (IEA) set out clear criteria for the translation of its passages and items. The passages and items were nationally and internationally verified, indicating that they were accurately translated from English (source language) to the other South African official languages, and back-translated to English. Any problems during the translation process would be flagged for corrections prior to data collection. For the purpose of this study, the Phase I analysis determined which items showed variance (despite strict translation procedures and verification processes) across the three selected languages by utilising descriptive statistics and Rasch measurement, specifically differential item functioning (DIF).

Phase II of the study included a per-item analysis of '*The Pearl*', which provided evidence of DIF. This study also presents the number and percentage of items correct. To further

explore the DIF results, a small selection of South African Grade 4 learner responses in English, Afrikaans and isiZulu was selected to further investigate reasons for the possible non-equivalence of the PIRLS assessment in South Africa. The data manager at the Centre for Evaluation and Assessment (CEA) randomly selected the PIRLS Literacy 2016 English, Afrikaans and isiZulu test booklets for an investigation. This is where learners had to provide written answers to questions. For the purposes of this study, only learners who completed the PIRLS Literacy assessment in English, Afrikaans and isiZulu were considered – a total of 836 learners.

6. Analysis of '*The Pearl*'

'*The Pearl*' is a realistic fiction literary work featured in the PIRLS Literacy 2016 cycle. The narrative revolves around a young boy named Reuben, who aspired to be a wealthy pearl merchant after his friend Josh discovered a precious pearl while they were swimming. Upon finding the pearl, Josh selflessly gifted the pearl to Reuben, who dedicated himself to learning about pearls and eventually achieved great success as a pearl merchant. As the story unfolds, Reuben's journey takes him from the tranquil seaside town to a bustling city, where pearls are bought and sold. While Reuben initially intends to spoil Josh with a lavish gift upon his return to the seaside town, his friend offers a different perspective. Josh suggests that Reuben's wealth could be better utilised for the benefit of their community. The explicit theme of the story revolves around Reuben's pursuit of his dream to become a pearl merchant, only to be reminded by his old friend that true fulfilment lies beyond mere wealth. The abstract theme, on the other hand, highlights the notion that genuine happiness does not stem from the collection of personal riches, but rather from sharing one's wealth for the well-being of others. Table 1 presents the key vocabulary (as indicated by the IEA) and the frequency with which each of the words appeared across the three languages for '*The Pearl*'.

Table 1: Key vocabulary across languages

IEA vocabulary	Frequency English	Frequency Afrikaans	Frequency isiZulu
oysters	1	1	2
eager	1	1	1
gleaming	1	2	1
shellfish	1 (oyster, shellfish, oysters)	1	1
merchant	0 (trader, traded, traders)	1	1
wealthy [a]	2 (rich, wealthy, rich, wealth)	3 (ryk, ryk, ryk, rykdom)	1 (zicebile, ecebile, wayecebile, ingcebo enkhulu)
seaside	2	1	2
generous	1	1	1
generosity	1	1	1

[a], 'wealthy' was selected by the IEA, however as it can take different forms such as 'wealth' or a synonym such as 'rich', a decision was made to add these to the table to show how the three languages used the term 'wealthy'.

As indicated by Table 1, the key words were carefully chosen as each word indicates a specific action, behaviour, emotion or a description and objects of '*The Pearl*'. Curiously, the word '*pearl*' was not selected by the IEA as a key word. One of the key words selected was '*merchant*'. However, this word was adapted for the national testing and '*traders*' was used in English whereas in the Afrikaans version, '*handelaar'* (trader) was used. In the isiZulu version of '*The Pearl*', the word '*umthengisi*' (merchant) was used. Another example of key words used was 'wealthy'. It was used once in the English version, but the count included '*rich*' and 'wealth'. The Afrikaans version of the passage counted '*ryk*' (wealthy) three times and included the word '*rykdom*'. Note that in Afrikaans, the word '*ryk*' is a homonym. The isiZulu version of '*The Pearl*' is more complicated than that of English and Afrikaans. The language structure is different due to the agglutinative nature of the language; the key words do not appear as a single unit (or word), such as in English and Afrikaans. The key words are embedded in complex morpho-grammatical structures, as such, the stem for '*wealthy*', that is, '*-cebile*' was counted three times.

Another example of the complexity of an agglutinative language is the key word '*oysters*'. In isiZulu '*kokhwathu*' was used. But when it was first introduced in the passage, '*kwembaza*' was used. The sentence in the passage reads as follows: "*Wafunda indlela amapharele akhula ngayo ngaphakathi kwembaza (oyster), uhlobo lwembaza (shellfish) ehlala olwandle* (He learned how pearls grow inside oysters, a kind of shellfish that lives in the sea)". The root word, '*mbaza*' and the locative prefix '*kwe*' were used to create '*kwembaza*'. The prefix means close to or next to an object or place (Wilkes & Nkosi, 2010).

7. Per-item analysis for '*The Pearl*'

A summary of '*The Pearl*' items, including the process of comprehension that is associated with each item, and the percentage of incorrect responses per language is depicted in Table 2.

Table 2: Percentage of Grade 4 learners who incorrectly answered items per language

Item No	Processes of Comprehension	English			Afrikaans			isiZulu		
		N Completed	% Incorrect	% Missing	N Completed	% Incorrect	% Missing	N Completed	% Incorrect	% Missing
3	FR	347	43	0,3	198	42	2	291	55	2
4	FR	347	44	1	198	45	1	291	53	2
6	FR	347	39	2	198	47	3	291	50	2
7	FR	347	36	1	198	42	5	291	53	4
8	FR	347	48	1	198	45	5	291	52	5
10	FR	347	41	3	198	40	9	291	44	7
12	FR	347	36	3	198	45	9	291	48	8
13	FR	347	37	7	198	45	9	291	56	9
14*	FR	347	25	2	198	32	9	291	49	11
1	SI	347	32	1	198	30	5	291	52	1
2*	SI	347	40	1	198	39	6	291	69	3
5*	SI	347	62	2	198	60	3	291	79	3
11	SI	347	75	6	198	69	11	291	80	7
9	II	347	67	4	198	63	4	291	78	5
15	II	347	78	3	198	79	7	291	87	9

FR - Focus on and Retrieve Explicitly Stated Information
SI - Make Straightforward Inferences
II - Interpret and Integrate Ideas and Information
*Indicates items that displayed DIF.

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DIF occurs when items do not function in the same manner for persons from different groups with the same ability. DIF means that persons who completed the same test do not have the same chance of responding correctly to that particular test or item (Sandilands et al., 2013). Table 3 provides an analysis of variance (ANOVA) test alongside the DIF. The table also includes the *F*-ratio and the *p*-value. The *F*-ratio is the ratio between two or more quantities that are anticipated to be the same under the null hypothesis, for instance, no difference between English, Afrikaans and isiZulu test items, whereas the *p*-value is the statistical model that provides evidence if the null hypothesis should be rejected (Field, 2009). For the purpose of this study, the ANOVA was conducted to compare the mean scores of the learners who completed the PIRLS Literacy assessment in English, Afrikaans and isiZulu. This was done to test the null hypothesis of the study, where the language group means are equal.

Table 3: DIF summary

Item	F-ratio	Probability
Item 14	19,097	0,000*
Item 1	6,810	0,001
Item 13	1,555	0,212
Item 10	2,032	0,132
Item 7	1,812	0,164
Item 6	1,517	0,220
Item 12	3,519	0,030
Item 3	0,347	0,707
Item 4	1,019	0,362
Item 8	1,849	0,158
Item 2	13,616	0,000*
Item 5	11,554	0,000*
Item 15	0,484	0,616
Item 9	3,894	0,021
Item 11	3,739	0,024

*Significant at the 5 percent level (Bonferroni 0.000521)

The DIF summary, including ANOVA statistics, for the PIRLS Literacy passage '*The Pearl*' is shown in Table 3. Only items with a small *p*-value, that is smaller than <0.05, are considered statistically significant in terms of uniform DIF. According to Andrich et al. (2012), uniform DIF occurs when persons from one group with the same ability have a consistently different probability of correctly responding to an item than persons from a different group. Of the 15 items from '*The Pearl*', only three items displayed differential functioning across the selected languages. These two multiple choice items (2 and 5) and one constructed response item (14).

To further investigate the non-equivalence observed across the three languages, distractor choices for the multiple-choice items were analysed, and a sample of learner-written

responses was collected and examined to evaluate the quality and fairness of the constructed-response item. Note that if the item displaying non-equivalence was a multiple-choice item, the entire sample's responses were utilised. The first item which showed DIF was item 2. The item is as follows:

Why are the children all eager to touch the pearl?

a. They want to take it away.
b. They think it is special. (correct answer)
c. They think the boy will drop it.
d. They do not believe it is real.

The following table depicts the number and percentage of English, Afrikaans and isiZulu learners who selected each of the distractors.

Table 4: Item 2: Distractor Responses by Language

Distractor	English Learners	% Selected	Afrikaans Learners	% Selected	isiZulu Learners	% Selected
A	31	9	24	12	71	24
B*	205	59	109	55	79	27
C	53	15	32	16	42	14
D	54	16	22	11	89	31
9 (not attempted)	4	1	11	6	10	3
Total	347	100	198	100	291	100

*Correct response (distractor B)

Of the three languages, it appears that the learners who completed the item in isiZulu found it to be more difficult, as only 27% selected the correct option (distractor B), whereas more than half of the English (59%) and Afrikaans (55%) selected the correct option. This finding led to a deeper look into the isiZulu passage to see whether the information contained in the text could partially explain the finding. The information in the text explicitly states "*ngoba zazibona ukuthi yinhle futhi iyabenyezela*" ('*because they saw that it was beautiful and shiny*'). As such, the text has sufficient information for the learners to infer that the pearl is something special. In addition, there is a picture that shows a boy who holds a shiny pearl that supports this interpretation. As part of the test instructions, learners were allowed to refer back to other pages and reread the passage; as such, the learners could review their answer and go back to the first page to infer that the pearl is a special object. Furthermore, it would appear that the isiZulu learners found distractors A (24%) and D (31%) too tempting. It is possible that the isiZulu word '*ipharele*' ('*pearl*') may be considered as unfamiliar for these learners, as they might not have seen a picture of a pearl before. So, these learners might not have prior knowledge about what pearls are and why they are considered to be special. However, since the passage provides a clear description of what a pearl is, what it looks like, where one can find pearls and how one can make an earning by selling pearls, learners should

be able to cope with the text as the information provided can assist them in building a rudimentary schema on the topic. On the other hand, a more skilled reader may have a different experience with the passage, as they may learn something new about pearls by reading the text. Skilled learners may also use the text to find answers, whereas some unskilled readers might rely on their own background knowledge to provide answers to the question rather than finding it in the text.

The next item, which displayed DIF, was item 5:

What does Reuben do differently after he gets the pearl?

This item required learners to provide a written answer by listing two things Reuben did differently after receiving the pearl from his friend Josh. To do so, learners had to make a straightforward inference based on the information in the passage. The item was worth two points. Based on the scoring guide, possible correct answers include that since Reuben obtained the pearl, he no longer played with his friends, Reuben started reading about pearls, he even wanted pearls for his birthday, and eventually, Reuben said that he wants to become a pearl merchant when he grows up. These thoughts and actions are written across two paragraphs in the text. The learners had to identify these thoughts and actions as 'being different' and provide them as their answers. Since this question is worth two points, learners could obtain a partially correct score, that is one point, if they provided only one correct answer.

Table 5 offers a snapshot of South African Grade 4 learners' written answers to the item. Note that for scoring purposes, the scorers were not allowed to mark spelling or grammar, but rather the answer contained in the writing, for instance, English learner 7's answer. Even though the learner made a few spelling errors, they provided two reasons why Reuben acted differently after he received his first pearl. The learner was awarded the two points.

Two English learners did not attempt to answer the question, compared to one Afrikaans learner and none of the isiZulu learners. In terms of partially correct answers, see, for example, English learners 1 and 8 and Afrikaans learners 2 and 5. None of the isiZulu learners had obtained a partially correct score. Some learners wrote nonsensical answers, such as English learner 9 and Afrikaans learner 8, where it appears that they copied letters randomly. It is not clear why these learners provided such answers. It is possible that these learners did not have basic reading and writing skills or were not at the appropriate grade level. Another possibility is that the learners were not interested in the task at hand and merely provided scribbles to appear as if they were taking part in the test. It is also possible that the learners experienced mind-wandering.

Table 5: Item 5: Grade 4 learner constructed responses

Learner number	English answer	Afrikaans answer	isiZulu answer
1	outdoors, whildren he stayed inside the played outdoors, he stayed inside	Not attempted	Ingoba wali thala embi shi Llihle futhi bobefuna uku lithsa
2	Not attempted	Hy leer hoe perels na Hy gaan endag 'n perelhandelaar	Wahamba wayohlala indiniwa funda amyalelo wampha abangibibakhe babona enga saphamelinga phande
3	Not attempted	Ruben het van die gehow En dit was mooi.	ukufunda incwadi nokukhuluma nabahgahi bakhe
4	Can I have it, Reaben. It really belongs to Josh.	Hy was gullukig. Hy het gese Ruben kan ma die ding kry	wayehlala endini akunde ukukhula ngayo ngaphankthi
5	Shellfish that lives in the sea. Present.	Leer oor perels Hy how baie we van a perels	lapho zona zidlala ngapnandle afunda indlela amapherele
6	He studied and reading about pearls. He wants to be a pearl trader	Hy het in die huis gebly as die ander kinders biute is. En as sy ours hom vra wat wil hy he vra hy altyd vir 'n pêrel	Wafunda ngalo izinto eziningi Umdeni wakubo umbuza angathanda umuphe sipho sini njalo nje wayecela ipharele
7	While hes friends went to play he stayed inside. Now when hes birthday comes he always askeds for pearls.	Van daardie dag af sien die ander kinders minder van Ruben. Vra hy altyd vir 'n pêrel	kwembaza oyster lwembaza shellfish
8	he learned how pearls grow inside oysters. A kind of shellfish that live in the sea	Hyadetikgetgetget Kgetgetegeye Hkaetge	Oyster Shellfish
9	Whe same si thesa llily? Ruamgil to wamesrimd?	Dit watter soont geskin n perel Ek gaan eenda n	ukutshengisa abantu ukuthi athi lehlukile kakhulu
10	While they played outdoors t he stayed inside reading about pearls. A kind of shellfish that lives in the sea. H learned how pearls grow inside oysatens.	Ruben bly binne en lees oor pêrels na. Hy leer hoe perels groei in oesters n soort skulpvis wat in die see leef.	Oyster Shellfish

Note. The colours indicate the correctness of each answer. Incorrect responses are red; a partially correct response is dark orange; a correct response is green; and nonsensical responses are in purple.

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Interestingly, isiZulu learners 8 and 10 only provided '*oyster*' and '*shellfish*' as their answers. This may be because the learners did not completely understand the question (what it expected of them to do) as these learners merely took the English words from the text. Two of the isiZulu learners obtained 2 points for providing two correct responses, while the remainder of these learners received a zero-point score. This is due to the learners not providing adequate reasons for Reuben doing things differently after he received the pearl. Table 6 depicts the partial credit breakdown of item 5 by language.

Table 6: Item 5: Partial credit breakdown

Points	English Persons	% Obtained	Afrikaans Persons	% Obtained	isiZulu Persons	% Obtained
0	135	39	58	29	169	58
1	81	23	61	31	59	20
2	124	36	74	37	54	19
9 (not attempted)	7	2	5	3	8	3
Total	347	100	198	100	290	100

The majority of the English, Afrikaans and isiZulu learners attempted to answer the question. The learners who completed the reading passage in isiZulu appear to struggle more with this item, as 58% received zero points, with only 19% receiving two points. While just over a third of English (36%) and Afrikaans (37%) received two points. Drawing from Table 5 and 6, it is clear that other than poor reading comprehension, there are several other reasons for the South African Grade 4 learners' poor performance – for instance, it could be that learners skim the question and do not carefully read it, they may not be used to providing longer written answers, the space provided for answering could also be confusing and they are probably not exposed or used to longer reading passages. In addition, the learners may not have sufficient test-taking stamina, which leads to test fatigue.

Next is item 14 of '*The Pearl'*. This item also displayed DIF and is considered easy as it only required learners to find explicitly stated information in the text.

What does Josh say they should do with Reuben's money?

a. get a new house
b. buy lots of pearls
c. share it with everyone* (correct answer)
d. take it back to the city

Table 7 depicts the number and percentage of English, Afrikaans and isiZulu learners who selected each distractor for item 14.

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Table 7: Item 14: Distractor responses by language

Distractor	English persons	% Selected	Afrikaans persons	% Selected	isiZulu persons	% Selected
A	46	13	39	20	76	26
B	23	7	15	8	45	15
C*	251	72	118	60	114	39
D	19	5	9	5	23	8
9 (not attempted)	8	2	17	9	33	11
Total	347	100	198	100	291	100

*Correct response (distractor C)

Even though this item required learners to retrieve information which was explicitly stated in the text, it appeared to be less difficult for learners who completed the item in English with majority (72%) of English learners who selected the correct answer, compared to Afrikaans (60%) and isiZulu (39%). Both Afrikaans and isiZulu learners found this item to be more difficult, with both these language sub-groups favouring distractor A. In the passage, close to the end of the story, Reuben asks Josh what he would like in return for his generosity – Reuben made specific reference to buying Josh a new house. This question required the learners to do perspective taking, that is, *what does X think*, and recursion, *where X said that… Y*. As such, a weaker reader might not understand who is saying what in the passage. Moreover, this finding may also show that learners accessed their own personal knowledge or memory when someone mentioned a house, rather than looking for the correct answer in the passage provided.

8. Discussion

A critical aspect of ILSAs is the necessity for test instruments to be equal across different languages and cultures (ITC, 2017; Peña, 2007). Analysing the performance of South African Grade 4 learners on '*The Pearl*' text revealed that these learners struggled considerably. To delve deeper into these descriptive results, Rasch analysis was conducted in Phase I on the larger mixed-methods study (see Roux, 2020). This analysis identified three items that functioned differently among English, Afrikaans, and isiZulu learners. Learner responses to these items were then qualitatively investigated in Phase II of the study. However, no consistent pattern of DIF emerged, indicating no universal bias against any particular language of testing for '*The Pearl*'.

Examining meso-level equivalence involved assessing whether the PIRLS Processes of Comprehension altered during translation across English, Afrikaans, and isiZulu. The analysis confirmed that the comprehension processes remained consistent across languages, indicating that the difficulty level of the reading comprehension tasks was equivalent across the three languages. This consistency provides partial evidence of equivalence at the meso level.

The PIRLS Literacy 2016 passage exhibited a rich vocabulary range, contributing to micro-level equivalence. The text's key word frequency, word and sentence length showed remarkable consistency across the languages, although the isiZulu orthography naturally resulted in longer words and sentences. This variation is consistent with the orthographic characteristics of isiZulu.

Despite evidence of meso-level equivalence, learners across English, Afrikaans and isiZulu specifically struggled with providing written responses to the items. Analysis of learner booklets revealed that these difficulties were a noteworthy factor in the poor reading comprehension results observed in ´The Pearl` in PIRLS 2016. Some items required learners to provide written responses up to three points. While the majority of learners attempted to supply answers to each item; however, many responses were incorrect. When items required learners to locate and copy answers from the text, some could not perform this task and often copied irrelevant text, indicating a lack of comprehension. Learners also struggled with longer, more complex responses, suggesting deficiencies in classroom practices, particularly in encouraging students to find text-based evidence for literal questions.

Notwithstanding the evidence of metric equivalence for most items in '*The Pearl*,' learners across languages found literal questions particularly challenging. Literal items, which were straightforward and text-based, required only basic interpretation of the text. These items, which were expected to be easy, were answered poorly by South African learners. Possible explanations for this include reading difficulties or disabilities (Mahdavi & Tensfeldt, 2013), inadequate decoding skills essential for reading comprehension (Spaull et al., 2020), and external factors such as teaching methods and parental involvement in literacy development (Mohammed & Amponsah, 2018; Pretorius & Klapwijk, 2016).

In conclusion, while there is substantial evidence of equivalence across languages regarding comprehension processes and vocabulary, significant challenges specifically remain in learner responses to constructed questions. These findings highlight the need for enhanced focus on teaching practices and support for developing foundational reading skills to improve reading comprehension among South African Grade 4 learners.

9. Limitations

The mixed-methods design allowed for examination of the PIRLS 2016 South African data from both a quantitative and qualitative perspective. However, this study only focused on three languages, namely, English, Afrikaans, and isiZulu, out of the 11 languages that were part of the large-scale assessment. Consequently, the findings emanating from this study are not generalisable to the South African Grade 4 population. Additionally, exploring an informational or factual text could provide deeper insights into the equivalence and possible measurement bias of South African Grade 4 learners' reading literacy skills.

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