### AN EXAMINATION OF THE LATENT CONSTRUCTS IN A WELLBEING SCALE FOR CHILDREN: APPLICATION OF RASCH MODEL

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### Abstract

The Children Wellbeing Scale (CWS) is a new scale released in 2019. Modern psychometric methodologies such as the Rasch Measurement Model (RMM) have not yet been applied to it. The data set was collected from young people in two Delta State local government areas using a convenience sampling technique (n=752). The sample consists of 45.5% males and 53.5% females. There were 24.4%, 54.3%, and 21.2% children aged 9-11 years, 12-14 years, and 15-17 years. Test of fit, local dimensionality, independence, category response thresholds, item

difficulty, individual ability, and reliability index are all part of the Rasch analysis and was applied in this study. Thirteen items were deleted from the scale because they did not fit into the RMM. As a result, the 11 variables with 63 items on the CWS were reduced to 10 factors with 50 items. The study's findings revealed that the CWS was unidimensional and confirmed local independence. The items' difficulty indexes were determined. There were more items with a little above average ability. The CWS's validity has been improved using the The instrument possesses RMM. characteristics appropriate for detecting and monitoring children's wellbeing in educational, health, and research settings.

**Keywords:** Wellbeing, Children wellbeing, Item Response Theory, Rasch Measurement Model, Children wellbeing scale

### Introduction

All educational and research tests, scales, and instruments must possess crucial measuring features such as reliability, accuracy, and validity. Users of these tests, scales, and instruments will be able to utilise them with confidence because of their measuring qualities (American Educational Research Association, American Psychological Association, and National Council on Measurement in Education [AERA, APA, & NCME], 2014; Brown & Bonsaksen, 2019; Steineret al., 2015). A test's or scale's validity can take numerous forms, and it is a constant, dynamic, and reciprocal exchange of data verification (Brown & Bonsaksen, 2019). As a result, the body of evidence regarding a scale's validity is never static; it is a dynamic process involving contributions from the scale's writers and other academics in the area. Factor analysis was used to verify the Children's Wellbeing Scale (CWS) (Alordiah, 2019). This study aims to look at the structural validity of the CWS utilising the Rasch Measurement Model for further evidentiary validity (RMM).

## Literature review

## The Children Wellbeing Scale (CWS)

The concept of wellbeing has a long history of use in education and health outcomes (Lundgren-Nilsson et al., 2013). Wellbeing has been an independent predictor of scholastic attainment in several young populations. The quality of a person's life is determined by their psychological, physical, and social circumstances (Alordiah, 2019). Measurement of wellbeing

aids policymakers in understanding the degree of wellbeing among children and adolescents. Information gleaned from wellbeing assessments will aid in identifying young people in society who require assistance. A child's wellbeing can influence academic success and social integration in an academic context.

There is strong evidence that half of the mental illnesses in adults begin before age 15 and that one out of every ten children aged 5 to 16 has been diagnosed with the mental disease (WiredGov, 2017). It is also recognised that schools play a crucial role in the fight against poverty, supporting and safeguarding the mental health and wellbeing of children and adolescent

Anxiety, suicide and psychosis, self-harm, and eating disorders are all examples of mental illnesses. One out of every ten school-aged children will experience a mental health problem at some point in their lives, with half of all mental health problems affecting children under the age of 18. Early intervention and assistance are critical for health issues that begin before the age of 14. It is critical to promote children's good wellbeing. According to a study conducted by the Children's Society in 2017, those external circumstances have a significant role in affecting the wellbeing of adolescents and teenagers and life changes. Six priorities have been established to enhance good wellbeing:

1. Ideal learning and development circumstances;

2. A favourable self-image and a strong sense of self-identity;

3. Having a sufficient amount of what is important;

4. Healthy interpersonal interactions with family and friends;

5. A secure and appropriate home environment and neighborhood; and

6. Possibility of participating in beneficial activities in order to flourish

Alordiah developed the Children's Wellbeing Scale in 2019 for children aged eight to eighteen. Originally, it had 73 things in it. After factor analysis, the ten items with a loading of less than 0.40 were removed from the scale. The scale's remaining 63 items were divided into eleven factors—factor one with ten items measures housing and environmental wellbeing. Factor two, with six items, measures education wellbeing. Factor three, with eight items, measures emotional wellbeing. Factor four, with six items, measures family wellbeing. Factor five comprises six items and tracks how much time is spent. Factor six has seven items; it measures safety and risk wellbeing. Factor seven with five items measures material wellbeing. Factor eight, with four items, measures friend/peer wellbeing. Factor nine has three items; it measures personal satisfaction. Factor ten, which has three items, assesses spiritual wellbeing, whereas factor eleven, which contains five questions, assesses health wellbeing.

The CWS can be given to an individual child or a group of children/young adults, and it takes around 20 minutes for them to complete. The children are asked to think about each of the 63 statements and select the option (Always with four points, Occasionally with three points, Rarely with two points, and Never with one point) that best represents them. A higher score indicates a higher level of wellbeing after all negative item codings have been reversed (Alordiah, 2019). The psychometric features of the CWS have only been evaluated through the lens of Classical Test Theory (CTT) (Principal Components Factor Analysis), not through the perspective of Item Response Theory (IRT) (Such as the Rasch measurement, 2PL, 3PL, and 4PL models).

### **Rasch Measurement Model (RMM)**

A kind of IRT, the Rasch measurement model, is a mathematical model that does not assume that each item on a scale has the same values or duplicates the same level of difficulty. The outcome of the RMM analysis is a hierarchical scale of items (easier to hardest) that identifies both human ability and item difficulty (Brown & Bansaksen, 2019). It is based on the idea that a person's response to an item is determined by the interaction between the individual and the item's difficulty level. In other words, according to the RMM's concept, respondents with higher levels of person ability are predicted to answer a greater number of scale items properly. In contrast, respondents with higher difficulty levels are expected to answer fewer scale items (Lim et al., 2009). The RMM gives fit data on whether scale items fulfil the Rasch model predictions, allowing researchers to determine the relationships between items and their weight within the overall construct and whether participants replied consistently and logically.

Furthermore, when fewer people agree on an item, the construct is more difficult to create. Item fit/misfit, dimensionality, response category probability, reliability, and the Wright person-item map are all RMM concepts. If each item fulfils the RMM's predictions, fit statistics (infit and outfit) of the data to the model may be computed. A good fit is defined as statistical values that are near 1.0. These are expressed as a mean square score (MNSQ, which ranges from 0.5 to 1.5). (Rahaya et al., 2020). Misfit components are usually recognised and deleted from the model. Only the scale components that contribute significantly to gauging the underlying scale construct should be kept. Dimensionality assesses specific qualities and determines how well they match the proposed model to determine whether they accurately measure the overall construct. It is proven when the statistics are within an acceptable range, and the data can explain most of the variation, demonstrating unidimensionality (Boone et al., 2014). In terms of local independence, the Rasch model requires that answers to items on the same scale be independent of one another; they must not be conditional. The residual correlation between items after the Rasch model is extracted can be used to discover response dependence. Greater than 0.4 inter-item correlations are a significant indicator of local response dependency. The logit ability rating for each response choice was compared using each item's threshold category probability curve to analyse the ordering of response option thresholds (i.e. the transition between adjacent response options when either response is equally likely). The answer option thresholds for all items were ordered; moving from one category to the next within each item reflects a rise in the underlying attribute of wellbeing (Bartram et al., 2013). The reliabilities of both persons and items are assessed in RMM. The person separation reliability metric assesses how successfully the instrument distinguishes between people on the measured variable. The person separation index is used to estimate the distribution of people on a given variable. The Wright map compares person and item dispersal (Rahaya et al., 2020).

#### **Purpose of the study**

The study's main purpose is to use the Rasch measurement model to examine the children's latent constructs in the wellbeing scale. Specifically, the study determined:

- The items fit of the Children Wellbeing Scale for the Rasch Measurement Model.
- The dimensionality and local independence of the items in the CWS.
- The measures (difficulty index) of the items in the CWS.
- The ordering of the response option thresholds of the CWS

- The items and person reliability estimates of the CWS.
- The presentation of the wright person-item map of CWS.

## Method

The study employs the Rasch Measurement Model in a quantitative scale validation approach. A convenience sample of 752 students was selected for this study from schools in two local government areas in Delta State- Ika South and Ika North East Local Government Areas (Brown & Bonsaksen, 2019). The children had to be between 9 and 17 and received authorisation from their school administration to participate in the study. If a child cannot read proficiently, they are not allowed to participate. The Children Wellbeing Scale was used in the research (CWS). It comprised 63 items and was verified using the CTT (Principal Component Factor Analysis) approach (Alordiah, 2019). The statistical package for social science version 23 was utilised for data input and analysis requiring descriptive statistics. The data were analysed using the Rasch model software. The goal of the data analysis was to check for model fit, assumptions, determine the difficulty index, category thresholds of each item, and create the CWS wright map.

# Results

## **Participants**

There were 752 children in the sample, 350 were males (45.5%), and 402 were females (53.5%). There were 184 (24.4%) children aged 9-11 years, 408 (54.3%) children aged 12-14 years, and 160 (21.2 percent) children aged 15-17 years among the participants. Ika South and Ika North East Local Government Areas accounted for 380 (50.5%) and 372 (49.5%) of the total.

## Item Fit

Table 1			
The meas	ures and fit statistics of the CWS		
CHILD	REN WELLBEING SCALE	INFIT	OUTFIT
CODE	ITEMS	MNSQ	MNSQ
Materia	l wellbeing		
1	There is a family car/motorbike for transportation.	1.86*	1.85*
2	My family/guardian has enough money to take care of my needs.	1.00	1.01*
3	I am never worried about money.	0.55	0.55
4	I have access to a computer at home.	1.41	1.41
5	I have access to the internet at home.	1.31	1.36
Health v	vellbeing		
6	I do physical exercise every day.	0.53	0.53
9	Doctors and other health workers treat me well when I have need to	0.49*	0.48*
	the hospital/clinic.		
11	I am healthy.	0.54	0.53
12	I feel I am too fat/thin	0.97	0.98
13	I feel dizzy.	0.97	0.96
Safety a	nd risk wellbeing		
14	I feel safe in my local environment.	0.50	0.50
15	I feel safe at home.	0.58	0.58
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17	I am not satisfied with the kind of people I see in my environment.	1.43	1.42
18	I am satisfied with the way car drivers and bike riders operate on our	0.49*	0.49*
19	I feel safe and secure in school.	0.59	0.56
20	I am involved in sex.	1.64*	1.64*
22	I am involved in a physical fight.	1.48	1.49
Educati	ion wellbeing		
23	I am satisfied with my school work.	1.04	1.03
24	I attend a standard school.	1.11	1.11
25	I have access to a computer in my school.	1.81*	1.81*
26	I have all my education items such as books, sandals, uniform, etc.	1.83*	1.82*
27	My teachers treat me well.	0.54	0.54
28	I am happy with the behaviour of the other children in my class.	0.41*	0.41*
Time us	sage		
29	I help around the house.	0.53	0.54
30	I have sufficient time to do my homework.	1.08	1.08
31	I am not overloaded with house chores.	0.44*	0.43*
32	I am satisfied with how I use my time.	1.12	1.12
33	I spend time on sport or/and exercise.	1.09	1.08
34	My time is well organised.	1.09	1.09
Persona	al satisfaction		
35	I feel good about myself.	0.51	0.51
36	I am proud of myself.	0.50	0.51
38	I am satisfied with my life.	0.50	0.51
Housing	g and environment		
39	I am satisfied with the house where I live.	0.46*	0.46*
40	I am satisfied with my environment	0.39*	0.39*
41	I am satisfied with the public transportation system in my	0.73	0.73
	town/area.		
42	The libraries in my town are working well.	1.02	1.01
43	Electricity is regular in my town/area.	1.41	1.41
44	I have access to borehole water.	0.97	0.97
45	My environment/area is neat.	0.95	0.96
46	Health facilities in my environment/are up to date	0.95	0.95
47	I have a space/room to myself at home.	0.95	0.96
48	In my home, I have space to play.	0.97	0.97
Family	wellbeing		
49	I am delighted with the way my parent/guardian treats me.	0.93	0.93
51	I can discuss any problem/issues with my parent/guardian.	1.07	1.07
52	My parents/guardian gives me pocket money.	1.02	1.03
53	I am happy when I come home.	0.97	0.98
54	As a family, we eat at least one meal together every day.	1.03	1.02
55	I argue or/and quarrel with my parent/guardian.	1.05	1.05
<b>Friend</b> /	peer wellbeing		
56	I am generally happy with my friends/mates.	0.95	0.95
57	I enjoy sharing my things with my friends/mates.	0.98	0.98
UDJCSE			51

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60	I can discuss a problem with a friend/mate without gettin quarrel.	£ 0.90	0.91
61	I respect my friend/mate's point of view on any issue.	0.93	0.93
Emotion	al wellbeing		
62	I find it difficult to sleep at night.	0.97	0.96
63	I feel depressed or/and frustrated.	0.92	0.92
64	I am lonely.	0.92	0.92
65	Have been bullied.	0.95	0.95
66	I witnessed my parents quarrelling and fighting.	0.98	0.98
67	I experienced the death of my close relatives.	0.96	0.96
68	I feel nervous or/and anxious.	0.91	0.91
69	I do not have control over what I think.	0.95	0.95
Religion	wellbeing		
70	I am happy with my religion.	2.06*	2.06*
71	I am satisfied with the place I worship.	2.11*	2.11*
72	I am happy with my religious activities.	1.89*	1.90*

Note: \*refers to misfit items

The RMM fit of the CWS is presented in Table 1. MNSQ values outside the range of 0.5-1.5 were identified as potential misfitting items. The MNSQ infit and outfit of the items in the CWS ranges from 0.39-2.11. Thirteen items showed mixfit. It implies that these items are not measuring the construct of wellbeing. These items were removed from the CWS to improve the scale's validity and to be able to carry out further analysis. This removal has reduced the number of items in the CWS to 50 items.



Figure 1: Item Characteristic Curve (ICC) of selected items

The ICC for items 32, 34, and 68 are good examples of a fit item, while items 71, 7, and 39 are misfit items (see Figure 1). The dot represents the observed scores for groups of people with similar total scores at the different ability levels. The closer the line with dots is close to the ICC, the better the fit. The best fit occurs when there is no gap between the two curves.

## Dimensionality and local independence

Principal component analysis was conducted on the retained 50 items in the CWS. A scale only measures a single dimension when the minimum variance explained by the measure is >30% (Linacre, 1998). The CWS showed a single dimension (unidimensionality), as values above 40.8% (18.7 in eigenvalues unit) of the variance explained by the measure were found. The inter-item correlations were less than 0.4. It implies that local independence condition has been met.

## Measures and category threshold

The partial credit model, suitable for the rating scale, was used to identify the measures and category threshold of the 50 items.

Table 2:

Measures and category threshold of CWS

S/N	CHILD	REN WELLBEING SCALE	b	THRESHOLD		
	CODE	ITEMS		1	2	3
Material wellbeing						
1	2	My family/guardian has enough money to take care	1.72	0.34	0.83	2.08
		needs.				
2	3	I am never worried about money.	1.76	0.59	1.08	2.33
3	4	I have access to a computer at home.	2.77	1.59	2.08	3.33
4	5	I have access to the internet at home.	2.68	1.54	2.03	3.28
	Health	wellbeing				
5	6	I do physical exercise every day.	1.92	0.54	1.03	2.28
6	11	I am healthy.	1.93	0.78	1.27	2.52
7	12	I feel I am too fat/thin	1.47	-0.11	0.39	1.64
8	13	I feel dizzy.	1.50	-0.12	0.38	1.63
	Safety a	nd risk wellbeing				
9	14	I feel safe in my local environment.	1.86	0.65	1.14	2.39
10	15	I feel safe at home.	2.01	0.83	1.33	2.58
11	17	I am not satisfied with the kind of people I see in	2.32	1.24	1.73	2.98
		my environment.				
12	19	I feel safe and secure in school.	1.74	0.76	1.25	2.50
13	22	I am involved in a physical fight.	0.40	-0.24	0.25	1.50
Eduo	cation we	llbeing				
14	23	I am satisfied with my school work.	1.38	0.19	0.68	1.93
15	24	I attend a standard school.	2.02	0.82	1.31	2.56
16	27	My teachers treat me well.	1.76	0.74	1.23	2.48
Time	e usage					
17	29	I help around the house.	1.82	0.72	1.21	2.46
18	30	I have sufficient time to do my homework.	1.66	0.53	1.02	2.27
19	32	I am satisfied with how I use my time.	1.60	0.35	0.85	2.10
20	33	I spend time on sport or/and exercise.	1.55	0.21	0.71	1.96
21	34	My time is well organised.	1.65	0.57	1.06	2.31

Pers	sonal satis	sfaction				
22	35	I feel good about myself.	1.78	0.63	1.12	2.37
23	36	I am proud of myself.	1.69	0.58	1.07	2.32
24	38	I am satisfied with my life.	1.72	0.57	1.07	2.32
Hou	ising and	environment				
25	41	I am satisfied with the public transportation	1.21	-0.17	0.32	1.57
		system in my town/area.				
26	42	The libraries in my town are working well.	1.40	0.04	0.53	1.78
27	43	Electricity is regular in my town/area.	0.44	-0.23	0.27	1.52
28	44	I have access to borehole water.	1.50	0.35	0.84	2.09
29	45	My environment/area is neat.	1.58	0.44	0.94	2.19
30	46	Health facilities in my environment/are up to date	1.59	0.41	0.90	2.15
31	47	I have a space/room to myself at home.	1.68	0.57	1.06	2.31
32	48	In my home, I have space to play.	1.61	0.44	0.93	2.18
Fan	nily wellbo	eing				
33	49	I am very delighted with the way my	1.74	0.45	0.94	2.19
		parent/guardian treats me.				
34	51	I can discuss any problem/issues with my	1.67	0.28	0.78	2.03
		parent/guardian.				
35	52	My parents/guardian gives me pocket money.	1.53	0.23	0.72	1.97
36	53	I am happy when I come home.	1.44	-0.17	0.32	1.57
37	54	As a family, we eat at least one meal together	1.57	0.11	0.61	1.86
		every day.				
38	55	I argue or/and quarrel with my parent/guardian.	1.53	0.09	0.58	1.83
Frie	end/peer v	vellbeing				
39	56	I am generally happy with my friends/mates.	1.34	-0.12	0.37	1.62
40	57	I enjoy sharing my things with my friends/mates.	1.41	-0.06	0.44	1.69
41	60	I can discuss a problem with a friend/mate w	1.33	-0.23	0.27	1.52
		getting into				
		quarrel.				
42	61	I respect my friend/mate's point of view on any	1.36	-0.21	0.28	1.53
		issue.				
Emo	otional we	ellbeing				
43	62	I find it difficult to sleep at night.	1.48	-0.01	0.49	1.74
44	63	I feel depressed or/and frustrated.	1.46	-0.05	0.45	1.70
45	64	I am lonely.	1.44	0.03	0.52	1.77
46	65	I have been bullied.	1.52	0.03	0.52	1.77
47	66	I witnessed my parents quarrelling and fighting.	1.66	0.19	0.68	1.93
48	67	I experienced the death of my close relatives.	1.61	-0.02	0.47	1.72
49	68	I feel nervous or/and anxious.	1.50	-0.17	0.32	1.57
50	69	I do not have control over what I think.	1.53	-0.05	0.45	1.70
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Note: b= Measure (Difficulty index). The Thurstonian threshold for a scoring category is defined as the ability at which the probability of achieving that score or higher reaches 0.50.

The measures (difficulty index) of the items in the CWS ranges from 0.40 - 2.77. Item 3 has the highest difficulty level, and item 13 has the lowest difficulty level (Table 2). The UDJCSE 55

person measures range from -0.28 - 3.61 (Figure 2). The persons' latent ability forms a normal curve around the mean (zero). Generally, most of the items' difficulty index was around 1.0 to 2.0 (Figure 2). The category response threshold for the CWS ranges from -0.24 to 3.33. It indicates that the responses to the CWS items were more located in the lower-middle range of wellbeing construct.



Figure 2: Wright map of CWS

The least endorsed item was 3. In contrast, the most endorsed item was 13. The persons' reliability was 0.89. At the same time, the item reliability was 0.812. Both reliability was found to be satisfactory.

## Discussion

The study's goal was to use the Rasch measurement model to re-examine the psychometric properties of the 63-item CWS (Bartram et al., 2013). The RMM is a mathematical model that encapsulates the principle of invariant comparison and guides the design of stable linear measurements. The distance between two person on the continuum does not depend on the items they responded to. Furthermore, the relative placement of two items does not depend on the persons who respond. As a result, a Rasch analysis aims to see how

well-observed rating scale data matches the measurement model. When the data does not match the model, it is extensively scrutinised to explain the misfit, but ultimately, data that meet the model's requirements are picked. According to the Rasch model fit assessment, the CWS data deviated from Rasch model expectations. The most misfitting items were eliminated successively to produce a 50-item scale based on item-fit data and assure validity (Lundgren-Nilsson & Tennant, 2011). The initial scale consisted of 63 items and 11 factors. After removing the misfitting items, it was reduced to 50 items with ten factors because one of the factors has all of its items eliminated. The 50-item Rasch scale was unidimensional and demonstrated local independence. The reliability, item difficulty, persons ability measure, and category threshold range were all judged to be good. If items are to be included, they should be items with an extremely low and extremely high difficulty index. The research has been able to back up a couple of literature that claims IRT is more exact (Brown & Bansaksen, 2019; Lim et al., 2009).

The convenience sample method used to enrol participants is one of the study's shortcomings. Participants were also recruited from a single geographic location, which might lead to sampling bias. Because there was no official funding for this study, it was not practicable or possible to recruit volunteers from a larger geographic region.

### Conclusion

The researcher was able to increase the validity of the Children Wellbeing Scale using the Rasch Measurement Model in this work. The tool possesses characteristics appropriate for detecting and monitoring children's wellbeing. The CWS can be used in various situations, including teaching, health care, and research.

## Recommendations

The researcher made the following recommendations:

- Educators, counsellors, and health practitioners should freely use the scale to establish the wellbeing index of children.
- The study should be replicated with a larger sample size recruited from a wider geographical region and randomly selected participants.
- Further investigation of the differential item functioning of the CWS concerning variables like gender, educational background, and location.
- The discrimination and guessing parameters should also be investigated using the 2PL and 3PL of the IRT models.

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