1   Psychometric Evaluation of the Bangla Communication Scale through Classical Test

2   Theory and Item Response Theory

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19   Abstract

20   One or two sentences providing a **basic introduction** to the field, comprehensible to a

21   scientist in any discipline.

22   Two to three sentences of **more detailed background**, comprehensible to

23   scientists in related disciplines.

24   One sentence clearly stating the **general problem** being addressed by this

25   particular study.

26   One sentence summarizing the main result (with the words "**here we show**" or their

27   equivalent).

28   Two or three sentences explaining what the **main result** reveals in direct

29   comparison to what was thought to be the case previously, or how the main result adds

30   to previous knowledge.

31   One or two sentences to put the results into a more **general context**.

32   Two or three sentences to provide a **broader perspective**, readily comprehensible

33   to a scientist in any discipline.

34   *Keywords:* keywords

35   Word count: X

Psychometric Evaluation of the Bangla Communication Scale through Classical Test Theory and Item Response Theory

Communication is a complex behaviour of exchanging information among individuals (Tanner, 2006). Communication plays a central role among adolescents in developing self-identity, social relationships and creates the foundation of collective social activity (Conti-Ramsden & Botting, 2008; Haslett & Bowen, 1989; Spencer, Clegg, & Stackhouse, 2013). Inadequate communication skill may cause poor peer relationship resulting long-term socio-emotional difficulties including social anxiety, stress, low self-esteem and poor academic performance (Brinton & Fujiki, 2004; Reed & Trumbo, 2020).

Often adults picture adolescents having inadequate and inept communication skills (Stern, 2005; Thurlow, 2003). Media representation of adolescents often includes "storm-and stress," self absorbed and disengaged type behaviours (Porteous & Colston, 1980; Stern, 2005). As such adolescents are often labelled as "lazy" and "disrespectful" by the adults (Agenda & America, 1999). On the contrary adolescents are highly engaged in work, community services and extracurricular activities and also more aspiring to earn an college degrees (DeBard, 2004; Schneider & Stevenson, 1999). Such a discrepancy between the reality of adolescent's image and adult's perception of the adolescents might be attributed to the mismatch of communication skills. The communication pattern of adolescents might not necessarily same as the adults. In addition to face to face communication, adolescents are vastly exposed to different virtual communication platforms. This may cause them to face more complex social challenges than the adults (Thurlow, 2003). "Communication capital" expresses the potential of civic-engagement that incorporates developing social relationships and influences collective social activity. The more communication capital an individual has the easier the instances of civic engagement become.

₆₂   Understanding the adolescents' communication skill vital as it is considered as the

₆₃ "key skill" in the education (Thurlow, 2001) and employment market (Olszewski,

₆₄ Panorska, & Gillam, 2017). In the western society, adolescents are now facing high

₆₅ unemployment (Lindsay et al., 2014). Lack of adequate communication skill is one of the

₆₆ root causes of this high unemployment (Lindsay et al., 2014). Similarly, lack of proper

₆₇ communication skill often promotes the propensity of anti-social behaviours and risk of

₆₈ exclusion from schools (Clegg, Stackhouse, Finch, Murphy, & Nicholls, 2009;

₆₉ Conti-Ramsden & Botting, 2004).

₇₀   To promote better understanding of subject contents assessing the communication

₇₁ skill among adolescents is highly required. For this purpose "Communication Skill"

₇₂ sub-skill set (Barkman & Machtmes, 2002) was developed in 2002 as a part of The

₇₃ National On-line Youth Life Skills Evaluation System (Mincemoyer, Perkins, & Munyua,

₇₄ 2005) and since then it has been extensively used (Fitzpatrick, Gagne, Jones, Lobley, &

₇₅ Phelps, 2005).

₇₆   This study has two objectives: (a) To explore and validate the latent construct of

₇₇ "Bangla Communication Scale" using (b) To gather concurrent validity evidence (c) To

₇₈ increase the precision of the scale usining Item Response Theory guided analysis ##

₇₉ Methods

₈₀ **Participants**

₈₁   A cross-sectional survey was used to collect data from a large sample of students

₈₂ of grade 8-12 (n = 300) from 8 schools following convenience sampling method. T. For

₈₃ estimating the sample size for the CFA we followed the N:q rule (Comrey & Lee, 1992;

₈₄ Schönbrodt & Perugini, 2013) which required 10 participants per parameters for

₈₅ trustworthiness of the result. Our sample size exceeds the requirement. Among 300

₈₆ participants, 218 were female aged between 12 to 21 years (15.89±1.46). 82 were male

87 with an age range between 13 participants 23 years (16.62±1.38). 282 (94%)

88 participants belonged to middle socio-economic status. 13 (4.3%) and 5 (1.7%)

89 participants belonged to lower and upper socio-economic status-respectively.

Procedure

91 　　Prior to data collection necessary authorization from school's authority and assent

92 from the participating were obtained. Data collection was commenced between

93 November 2021 to January 2022. The data collection took place in the classroom where

94 students were at first briefed about 'communication skill.' Next. they filled up their

95 soci-demographics information and responded to our Bangla Communication Scale. All

96 personal information (name, school,class) was codified and encrypted, producing a

97 anonymous database.

Materials

Communication Scale.

Bangla Communication Scale. We translated the "Communication Scale" into

101 Bangla Language following International Test Commission (ITC) guidelines (Bartram et

102 al., 2018) to translate and adapt Communication scale. Two bilingual researchers (PhD

103 in Psychology) natives in Bangla translated the original English version to Bangla. Two

104 translated versions were then judged and synthesized by the authors. Subsequently, two

105 bilingual researchers (One PhD, one MS in Psychology) back-translated the Bangla

106 scale into English with no knowledge of the original work. The authors synthesized the

107 two back-translations and compared it with the original scale and made necessary

108 amendments

Item Analysis

Scree plot, map and hull method (Figure 2) suggested a one factor solution. Horn's parallel analysis (Horn, 1965) with 500 iterations indicated a two-factor solution. However, the minimum average partial (MAP) method (Table **??**) (Velicer, 1976) and Hull method (Lorenzo-Seva, Timmerman, & Kiers, 2011) (Figure 2) suggested a five-factor solution. As a result, we tested both five-factor and six-factor solutions.

Measurement Invariance

To gather more information on our retained one-factor solution, we sought Item Response Theory (IRT). IRT complements the conventional classical test theory-based analysis by gathering information on item discrimination and item difficulty. IRT judges an item's quality by providing item information in the light of participants' trait level (θ). We gathered evidence on item quality as well as item fit, person fit and model by fitting a graded response model in RStudio with the "mirt" package (Chalmers, 2012) (Chalmers, 2012). We did a Monte Carlo simulation using "SimDesign" package (Chalmers & Adkins, 2020) with sample sizes varying from 50-350 and calculated average root mean squared error(RMSE) to estimate the optimal sample size for the graded response model with 23 items. The RMSE became stable for n = 200 to 300 (RMSE ranging between .25-.35). Our sample size within the estimated sample size for stability.

Marginal reliability is based on the true score model (Lord & Novick, 1968) and is an estimate of the overall reliability of a test based on the average conditional standard errors. Often it is close in value to coefficient alpha (and sometimes it may even be identical). Alpha provides a lower estimate of marginal reliability.

131   **Results**

132   **Discussion**

133 **Ethical Consideration**

134   All procedures performed in studies involving human participants were in

135 accordance with the 1964 Helsinki declaration and its later amendments or comparable

136 ethical standards. This article does not contain any studies with animals performed by

137 any of the authors.

138 **Data and code availability**

139   All code and data underlying this article is available on a public GitHub repository

140 (https://github.com/masiraji/Communication).

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Table 1

Items	Mean	SD	Skew	Kurtosis	Shapiro-Wilk Statistics	Item-Total Correlation
CS01	2.97	1.02	-0.65	-0.43	0.84*	0.20
RCS02	2.51	1.18	-0.26	-0.96	0.89*	0.26
CS03	2.94	1.09	-0.72	-0.44	0.84*	0.35
CS04	2.47	1.23	-0.42	-0.79	0.89*	0.33
RCS05	2.50	1.31	-0.48	-0.87	0.87*	0.08
CS06	2.82	0.97	-0.62	-0.01	0.87*	0.40
CS07	2.70	1.16	-0.63	-0.59	0.86*	0.41
CS08	2.92	1.07	-0.87	0.00	0.84*	0.36
CS09	3.60	0.76	-2.24	4.73	0.56*	0.18
CS10	3.08	0.97	-0.81	-0.18	0.82*	0.34
CS11	3.17	1.00	-1.07	0.40	0.78*	0.52
CS12	2.58	1.19	-0.40	-0.83	0.89*	0.43
CS13	3.22	1.12	-1.35	0.81	0.72*	0.29
CS14	2.82	1.10	-0.79	-0.06	0.86*	0.43
CS15	3.34	0.82	-1.19	1.19	0.76*	0.51
CS16	2.63	1.26	-0.45	-1.00	0.87*	0.28
CS17	2.20	1.33	-0.04	-1.22	0.89*	0.36
CS18	2.86	1.07	-0.76	-0.11	0.85*	0.38
CS19	2.03	1.23	-0.08	-0.93	0.91*	0.44
CS20	2.73	1.00	-0.44	-0.47	0.88*	0.52
CS21	2.79	1.08	-0.66	-0.25	0.87*	0.56
CS22	3.00	1.06	-0.94	0.26	0.82*	0.44
CS23	2.31	1.22	-0.12	-0.91	0.90*	0.05

Table 2

Measurment Invariance analysis on CFA sample (n=262) across native and non-native English speakers.

	Chi-Square	df	CFI	TLI	RMSEA	RMSEA 90% Lower CI	RMSEA 90% Upper		Chi-Square Difference	df difference*	p	NA
Configural	245.13	238.00	0.99	0.99	0.01	0.00	0.04	0.08	-			-
Metric	280.35	254.00	0.98	0.97	0.03	0.00	0.04	0.08	13.481a	16		0.637
Scalar	290.78	270.00	0.98	0.98	0.02	0.00	0.04	0.08	13.002b	16		0.673
Residual	303.44	287.00	0.98	0.98	0.02	0.00	0.04	0.09	14.008c	17		0.667

Note. a = Metric vs Configural; b = Scalar vs Metric; c = Residual vs Scalar; * = df of model comparison

Table 3

Items discrimination and response category difficulty thresholds of 17 items in Bangla Communication

Items	a	b1	b2	b3	b4	Standardized Outfit	Standardized Infit	S-Chi-square
CS03	0.67	-5.51	-3.25	-1.18	0.69	-0.73	-0.59	80.74
CS04	0.92	-2.92	-1.46	-0.15	1.61	-1.34	-1.09	86.36
CS06	0.72	-5.36	-3.25	-1.09	1.50	-0.50	-0.61	101.14
CS07	0.90	-3.83	-2.04	-0.76	1.16	-1.18	-0.95	77.50
CS08	0.88	-4.44	-2.63	-1.19	0.75	-1.10	-0.82	71.65
CS10	0.64	-6.98	-3.98	-1.57	0.84	-0.62	-0.50	89.19
CS11	1.22	-4.06	-2.83	-1.40	-0.10	-1.18	-0.87	60.34
CS12	0.82	-3.82	-1.97	-0.34	1.23	-0.80	-0.91	76.70
CS13	0.75	-4.81	-3.17	-1.89	-0.29	-0.75	-0.53	76.21
CS14	0.75	-4.88	-2.93	-0.99	1.34	-0.96	-0.80	64.03
CS15	1.16	-4.00	-3.30	-1.70	-0.09	-1.10	-0.77	64.76
CS17	0.89	-2.74	-0.94	0.43	1.78	-1.14	-1.26	75.92
CS18	0.71	-5.54	-2.98	-1.37	1.02	-0.61	-0.61	92.33
CS19	1.01	-2.11	-0.92	0.60	2.31	-0.87	-1.13	96.62
CS20	1.15	-4.16	-2.10	-0.60	1.22	-1.56	-1.49	69.01
CS21	1.20	-3.46	-2.08	-0.73	0.91	-1.67	-1.39	56.50
CS22	0.66	-5.71	-3.67	-1.66	0.68	-0.79	-0.53	70.85

Note. a = item discrimination parameter; b(1-4) = response category difficulty parameter

Table 4

Correlation matrix of the main variables

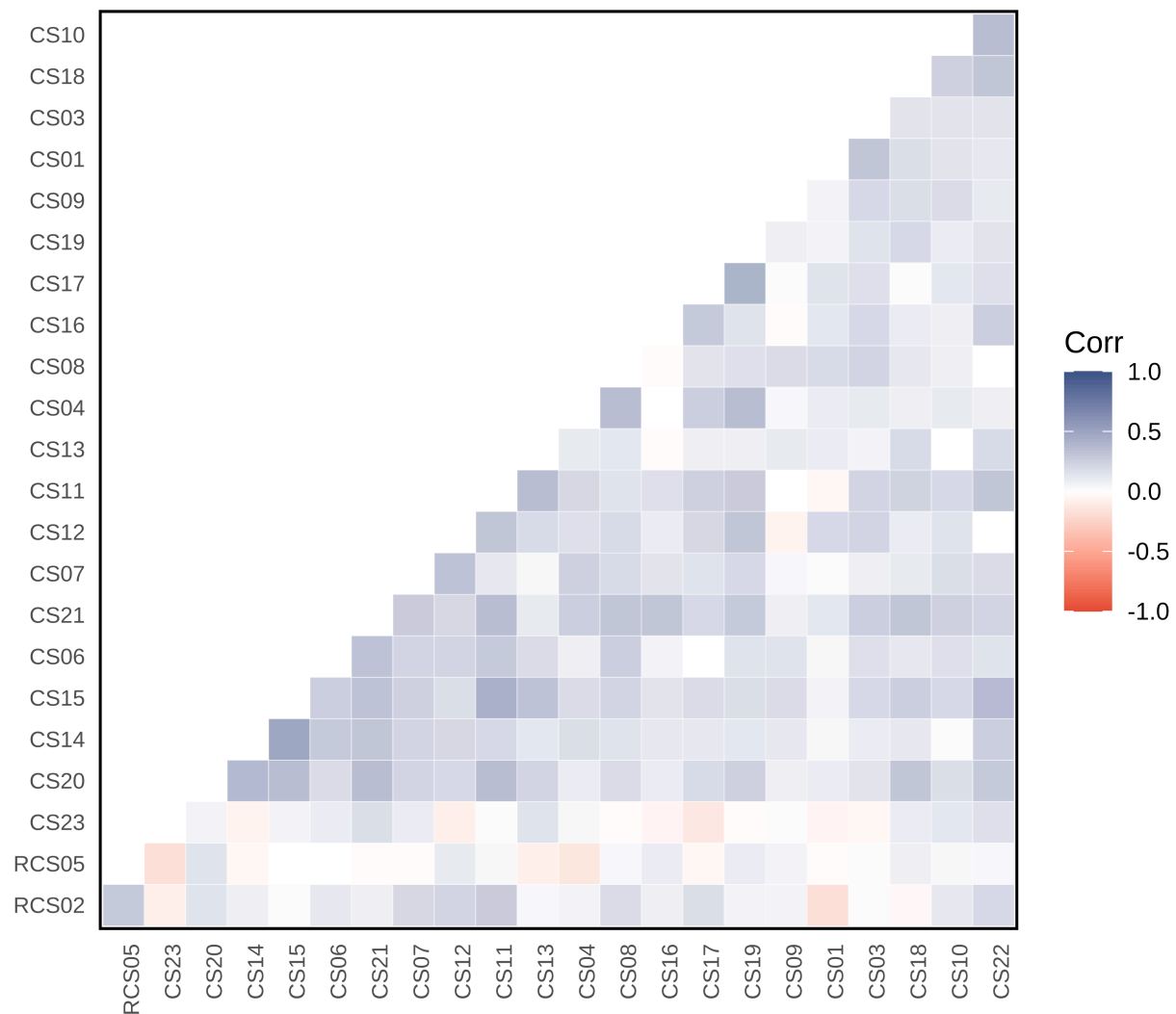|	1	2	3
1 Communication			
2 Hopelessness	-.16*		
3 Life Satisfaction	-.02	.02	
4 SE	.04	-.58**	-.07

Note. **p < .001

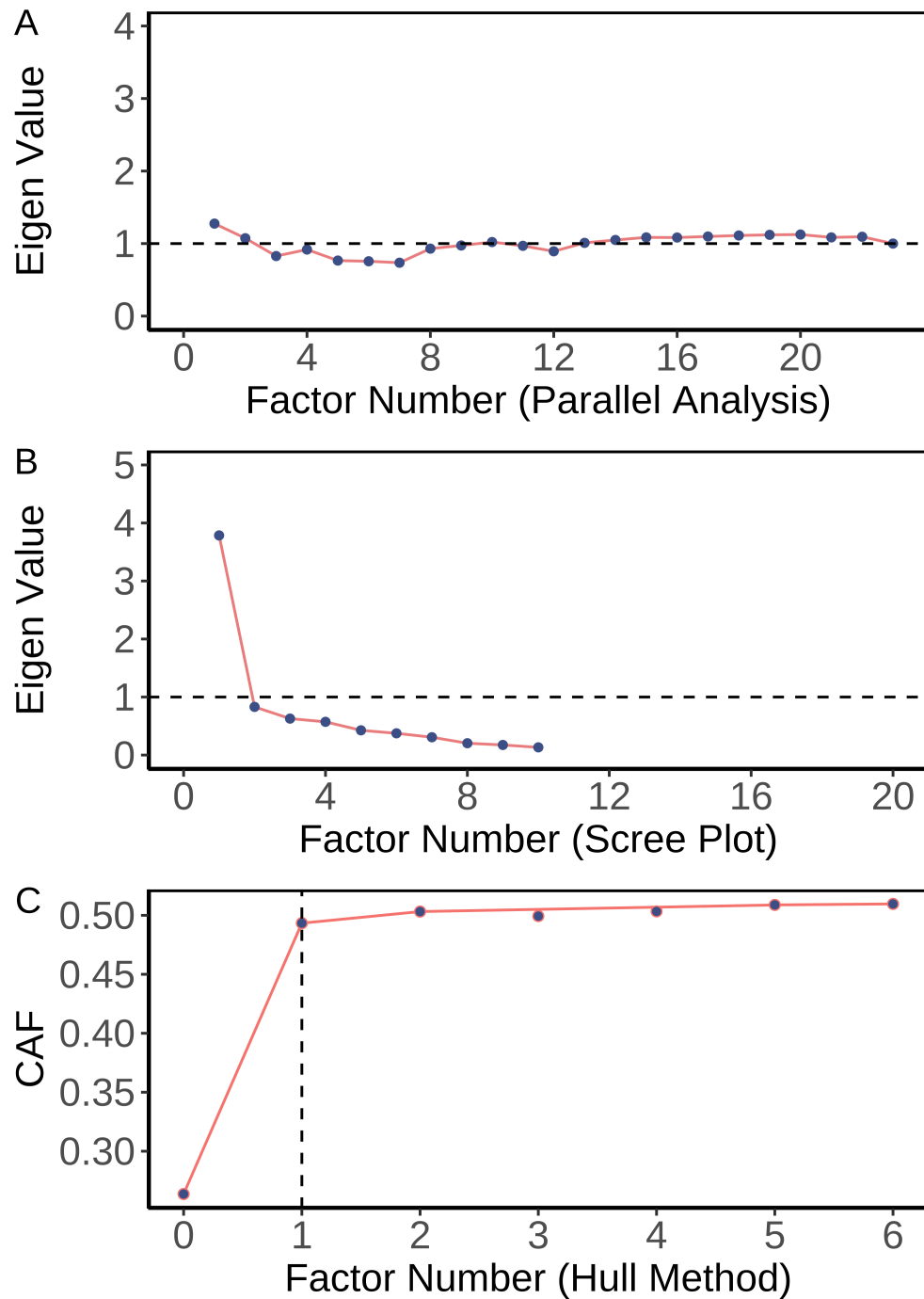*Figure 1*. Inter item polychoric correlation coefficients for the 48 items. 4.9 % inter-item correlation coefficients were higher than .30

Figure 2. Factor Identification Methods (A) Parallel analysis indicated the optimal number of factors were two. (B) Scree plot suggested One factor. (C) Hull method indicated one factor were required to balance the model fit and number of parameters.
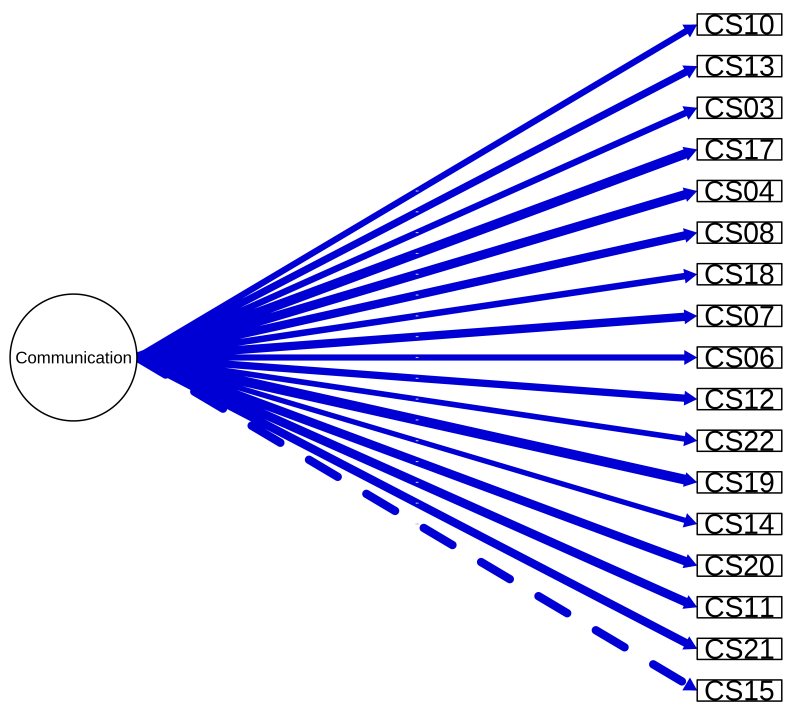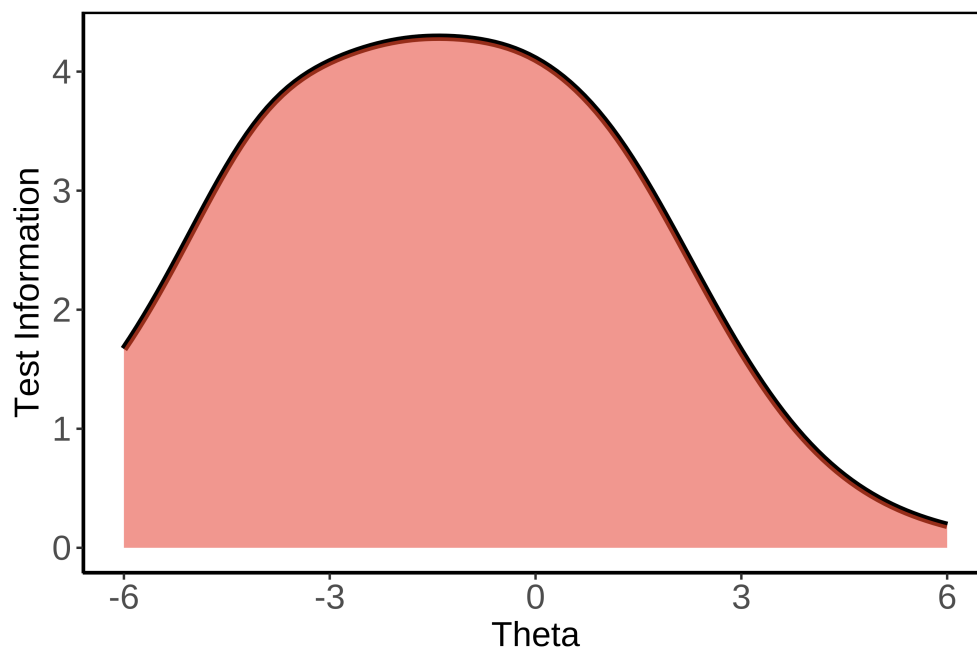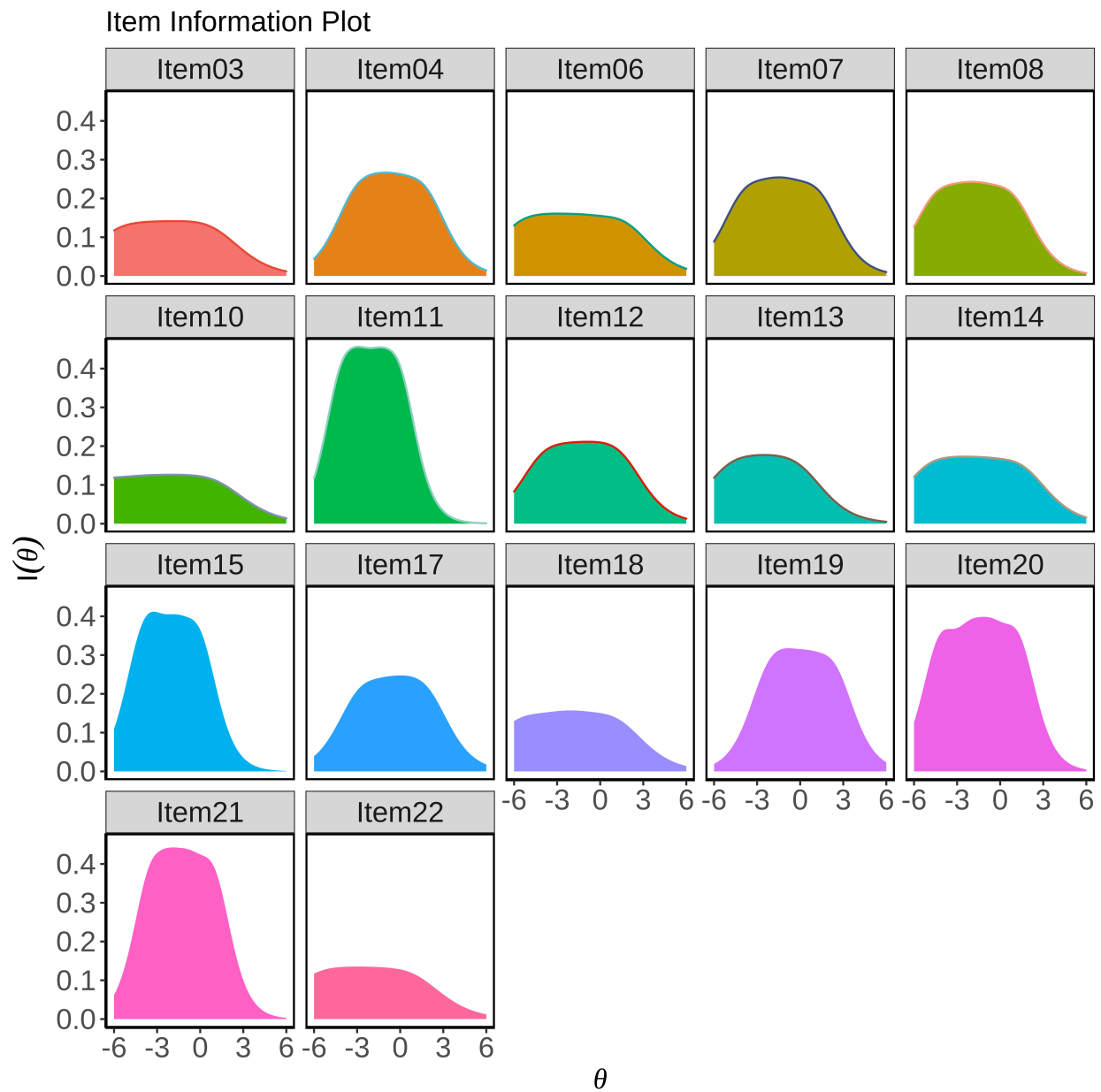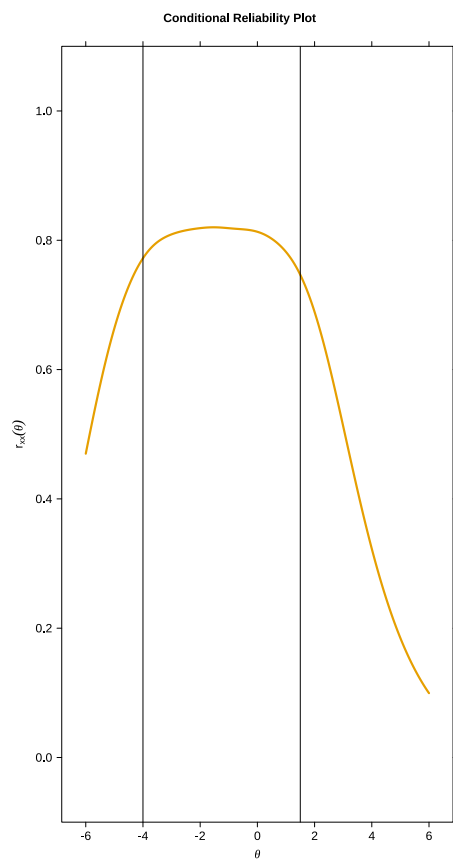
Figure 3. CFA Plot.

Figure 4. TIC.

Figure 5. Item Information Curve.

Figure 6. Conditional Reliability.