



# Rasch Analysis and Item Reduction of the Chinese Version of the 20-item Toronto Alexithymia Scale (TAS-20-C) for Adolescents

Barry K. H. Tam<sup>1</sup>, Wing S. Wong<sup>2</sup>

<sup>1</sup>Research Department of Clinical, Educational & Health Psychology, University College London, UK

<sup>2</sup>Department of Psychological Studies, The Hong Kong Institute of Education, Hong Kong

ka.tam.10@ucl.ac.uk wingwong@ied.edu.hk



## INTRODUCTION

Alexithymia encompasses four dimensions, namely, a difficulty in identifying and describing feelings, confusion to distinguish between emotional arousals and bodily sensations, a poverty of imagination and fantasy life, and a concrete, reality-based cognitive style.<sup>1</sup> The 20-item Toronto Alexithymia Scale (TAS-20) was designed to assess alexithymia in adult samples.<sup>2</sup> Both exploratory and confirmatory factor analyses revealed that alexithymia can be best represented as a three-factor model, including (1) difficulty of identifying feelings, (2) difficulty of describing feelings, and (3) externally oriented thinking.<sup>2,3</sup>

Given that alexithymia was found to be associated with the functioning of corpus callosum<sup>4</sup> which develops robustly in adolescents,<sup>5</sup> the use of TAS-20 on adolescents remained an open question. In light of this, the present study has two aims. First, this study aims to refine the TAS-20 for adolescent populations by using Rasch modelling analyses and the factor structure of the refined measurement of alexithymia will be evaluated by exploratory factor analysis (EFA) (Study 1). Second, this study also aims to examine how far the results of EFA could be extended to Chinese adolescents in different grade levels by utilizing multiple-group confirmatory factor analysis (CFA) (Study 2).

## STUDY 1

### PARTICIPANTS & PROCEDURES

Subjects were recruited from six secondary schools in Hong Kong. A total of 500 (from the first to the fifth forms) Chinese adolescents were recruited, comprising the first ( $n=138$ ), second ( $n=134$ ), third ( $n=139$ ) and senior ( $n=89$ ) formers in the present study.

### INSTRUMENTS

-The Mandarin version of the TAS-20 (TAS-20-C)<sup>6</sup> was slightly modified to accommodate colloquial usage.  
-20 items rated on 5-point Likert scale

Figure 1 Item map of TAS-20-C

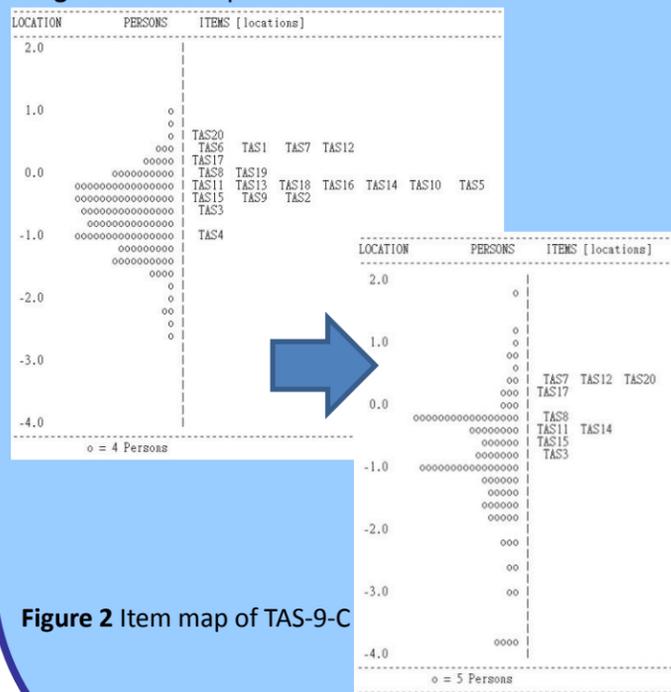


Figure 2 Item map of TAS-9-C

### STATISTICAL ANALYSES

Rasch analysis was applied to inform our item selection. Individual item fit was assessed using residual values and differential item functioning (DIF). Throughout this process, the item map was consulted to identify redundant items. The factor structure of the selected items was then examined by EFA using oblique promax rotation. All items should be loaded on its principal component(s) with a loading above the minimum criterion for saliency ( $r \geq 0.40$ ). The internal consistency (Cronbach's  $\alpha$ ) of the entire instrument were assessed.

### RESULTS

Rasch analysis of the TAS-20-C indicated that it did not fit the model (total item  $\chi^2=1245.68$ ,  $df=140$ ,  $p<0.001$ ; fit residual mean for item (standard deviation)=0.92 (4.18)). Rescoring was performed according to threshold ordering.<sup>7</sup> Items 1, 2, 4, 5, 6, 9, 10, 11, 13, 14, 16, 18 and 19 had significant misfit (fit residual ranging -3.73 to 9.62). None of the item exhibited DIF by grade levels or latent trait ability x grade levels. Having consulted the item map on distribution of the underlying trait of alexithymia (Fig 1), item 1, 2, 4, 5, 6, 9, 10, 13, 16, 18 and 19 were then removed. The person separation index slightly increased (from 0.78776 to 0.81611), indicating that remaining items (TAS-9-C) retained reasonable measurement variables of TAS-20-C (Fig 2).

Results of EFA on the TAS-9-C yielded a one-factor model accounting for 38.23% of the total variance (eigenvalue=3.44;  $r \geq 0.46$ ). Internal consistency of the scale was good ( $\alpha=0.79$ ).

## STUDY 2

### PARTICIPANTS & PROCEDURES

A total of 1294 (from the first to the fifth forms) Hong Kong Chinese adolescents were recruited, comprising the first ( $n=358$ ), second ( $n=346$ ), third ( $n=359$ ) and senior ( $n=230$ ) formers in this study.

### INSTRUMENTS

-The TAS-9-C which consists of 9 items rated on 5-point Likert scale.

### STATISTICAL ANALYSES

The one-factor model specified the 9 items of the TAS-9-C on a single latent construct (i.e., alexithymia) was examined. Model fit was assessed using  $\chi^2$  statistics, CFI, NNFI, RMSEA, and 90% CI of RMSEA.

### RESULTS

Results of CFA replicated the one-factor model reported in Study 1 in the current Chinese adolescent sample (CFI=0.962). Factorial invariance was also evidenced across different grade levels (Table 1).

Table 1. Results of CFAs testing factorial invariance of the hypothesized one-factor model applied to TAS-9-C in different adolescent samples

Model	$\chi^2$	S-B $\chi^2$	df	p value	CFI	NNFI	RMSEA	90% CI
One-factor model								
1. First Formers	533.785	44.793	27	0.02	0.964	0.952	0.043	0.018, 0.065
2. Second Formers	573.093	45.716	27	0.01	0.965	0.954	0.045	0.020, 0.067
3. Third Formers	643.335	49.573	27	0.01	0.963	0.950	0.048	0.026, 0.069
4. Junior Formers (F1-3)	1650.673	87.074	27	<0.001	0.963	0.950	0.046	0.035, 0.057
5. Senior Formers (F4-5)	488.783	42.968	27	0.03	0.965	0.953	0.051	0.018, 0.078
Model comparisons								
1 vs. 2								
Constrained	1134.750	93.784	71	0.04	0.978	0.975	0.021	0.006, 0.032
1 vs. 3								
Constrained	1272.967	141.510	71	<0.001	0.941	0.933	0.037	0.028, 0.046
Constrained with some free coefficients	1218.018	105.859	65	0.001	0.964	0.958	0.030	0.019, 0.040
$\chi^2$ difference test	S-B $\chi^2_{df=5} = 87.901$		df <sub>df=5</sub>	$p < 0.01$				
2 vs. 3								
Constrained	1289.730	108.614	71	0.003	0.969	0.964	0.027	0.016, 0.037
4 vs. 5								
Constrained	2339.827	162.800	71	<0.001	0.959	0.954	0.032	0.025, 0.038
Constrained with some free coefficients	2314.566	151.226	69	<0.001	0.963	0.957	0.030	0.024, 0.037
$\chi^2$ difference test	S-B $\chi^2_{df=1} = 29.808$		df <sub>df=1</sub>	$p < 0.01$				

CFA confirmatory factor analysis; CFI, comparative fit index; TAS-9-C, Chinese version of 9-item Toronto Alexithymia Scale; CI, confidence index; df, degrees of freedom; NNFI, normed fit index; RMSEA, root mean squared error of approximation; S-B  $\chi^2$ , Satorra and Bentler scaled chi-square statistics;  $\chi^2$ , chi-square statistics.

## CONCLUSIONS

The TAS-9-C is a valid and reliable instrument to be employed among adolescents across different grade levels. Future research on the specific role of alexithymia in explaining presentation of somatic symptoms with regard to both neurological and psychological processes is desirable.

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