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Dimensionality and Factor Structure for the TRIAD Social Skills Assessment (TSSA) within Malaysian Context

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***Abstract*—The initial Scale of TRIAD Social Skills Assessment (TSSA) was developed to enable the mainstream or special education teachers in providing information on the descriptions of social skills among students with Autism Spectrum Disorder (ASD) under the Inclusive Education Programme (IEP). There were four subscales namely; Initiating Interactions (II), Affective Understanding/Perspective Taking (AU/PT), Responding to Initiations (RI) and Maintaining Interactions (MI) of which were being identified by Wendy et al. (2010). The purpose of this study is to explore the cross-validating and reliability testing of the scale among Malaysian students with ASD who are involved in IEP. Measures of Rasch Measurement Model (RMM) Item Analysis and Exploratory Factor Analysis (EFA) that have been conducted, showed that TSSA (within Malaysian context) is a multi-dimensional scale with four factors structured. Cronbach's alpha reliability coefficient value was at 0.960. Therefore, results indicated that the 24-item-TSSA can serve as a valid and reliable instrument for social skills assessment among students with ASD in IEP classrooms within Malaysian context.**

Keywords—social skills assessment; autism spectrum disorder; inclusive education; teacher rating form

I. INTRODUCTION

The number of children with ASD has been skyrocketed. The Center for Disease Control and Prevention (CDC) reported of a 30 percent increase in the prevalence rate of autism in United States of America over a period of four years, from 1 in 88 (2008) to 1 in 68 (2012) [1, 2]. In line with the United States of America, the Final Mapping Report of Malaysia [3] revealed that the prevalence of children with ASD (0 to 18 years old) increased from 5.23% of the total number of children diagnosed with disabilities in year 2011 to 6.15% in year 2012.

According to American Psychiatric Association (APA) [4], Autism Spectrum Disorder (ASD) is categorised under neurodevelopmental disorders which is characterised by persistent deficits in social communication and social interaction across multiple context, including deficits in social reciprocity, nonverbal communicative behaviours used for social interaction and skills in developing, maintaining and understanding relationships. Children with ASD experience specific social difficulties that are different from children with other developmental disabilities. Understanding their own and others emotions, how to convey their feelings and recognise other's feelings, knowing how to start and maintain interactions appropriately, and understanding other people's perspectives are some examples of difficulties experienced by children with ASD [5].

In Malaysia, effort to include students with ASD in mainstream classrooms is related to the move for inclusion world widely. Inclusive Education (IE) Program will help the children with ASD to develop their social skills and grow up in a normal environment alongside with their typical peers [6]. Majority research showed that teachers perceived positively towards the implementation of IE Program. However, when it comes to real IE Programme classrooms practices and experiences, mixed feeling was expressed [7].

Teachers require access to efficient strategies for the socialization assessment of children with ASD. This is in order to identify their problems in specific as well as to initiate strategies for intervention. However, a review showed that there is the lack of common assessment can be recommended to improve social skills among children with ASD due to the diversity of the types of the interventions used. It is important to make informed decisions among the practitioners within the school setting in utilising a standardized assessment to carry out the individualized social skills improvement plan especially among the students with ASD [8].

Furthermore, there were several research regarding the social skills among students with ASD that have been carried out in Malaysia. However, there is yet to have a standardized social skills assessment with the psychometric evidence

locally. Thus, the TRIAD Social Skills Assessment (TSSA) [5] was chosen to be adapted into Malaysian context. Therefore, researchers decided to adapt and it came up to be an useful instrument which is valid and reliable to other researchers in Malaysia.

II. METHOD

The TSSA [5] was developed originally by TRIAD autism specialists to address the need for a relatively brief, easy-to-administer tool for evaluating the complex social profiles of children with ASD, identifying strengths and challenges in the social domain and providing recommendations for intervention planning through individualised goals and specific strategies. Used in-house for ten years, the TSSA recently has been updated for use in a variety settings, including the school and community.

This assessment is designed for children ages 6-12 years who have basic reading skills. It is criterion-based and assesses knowledge and skills in three areas, namely, cognitive, behavioural and affective. The cognitive areas assess the child's ability to understand other people's perspectives. The behavioural aspects determine the child's ability to initiate and maintain interactions and respond appropriately to other people. The affective components evaluate the child's ability to understand basic and complex emotions.

To suit with this study, researcher adopted the Social Skills Survey under the Teacher Rating Form in order to enable the mainstream or special education teacher to provide information on descriptions of social skills among students with ASD in school setting. There were 35 questions being chosen by researcher to form the assessment tool. There were four subscales involved, namely, Affective Understanding/Perspective Taking (AU/PT) – 6 items, Initiating Interactions (II) – 10 items, Responding to Initiations (RI) – 5 items and Maintaining Interactions (MI) – 11 items. The respondents rated the child on a four-point scale ranging from "Not very well" to "Very well".

A. Cross-cultural Adaptation Procedures

For the cross-cultural adaptation of scales, researcher has gone through a few critical stages that being emphasised in Bourzgui et al. [9], Silveira et al. [10] and Chae, Kim and Yoo [11] which included ethical considerations, forward and backward translation as well as expert validation.

B. Construct Validation

During pilot study, there were 34 respondents in Johor involved. Researcher carried out the Rasch Measurement Model (RMM) item analysis using WINSTEPS Version 3.72.3 [12] to examine the construct validity of the questionnaire. In order to obtain a valid instrument, there are two vital assumptions must be fulfilled in the RMM where the data must fit the model and must be unidimensionality [13].

It was crucial too to identify the underlying constructs of the adapted scale in the instrument within Malaysian context. In this study, researcher explored the underlying constructs of the four adapted subscales via the Exploratory Factor Analysis (EFA) using the data for the whole population of 267 respondents in Selangor via IBM SPSS Statistics 24 and applied the five-step EFA protocol which proposed by Williams, Brown and Onsman [14].

C. Reliability Testing

Internal consistency reliability as one of the common estimators of reliability has been established for the adapted scales in the questionnaire [15]. Therefore, researcher computed the Cronbach's alpha for each adapted subscales in the instrument for this study by using IBM SPSS Statistics 24.

III. RESULTS AND DISCUSSION

A. Item Statistics

To identify whether the data fit the model, researcher performed a three-step comparison procedure. Starting with point measure correlation value (PMC) then followed by infit and outfit mean square (MNSQ) and finally, infit and outfit standardized z value (ZSTD). All the value mentioned above were being examined and compared sequentially within the range of acceptable fit indices.

PMC calculates the index of the item discrimination where the item with greater value might be too good to other items. The acceptable region for PMC is between 0.28 and 0.86 [16]. The two statistics, infit and outfit of MNSQ as well as ZSTD are used to identify the relationship between the item difficulty and individual ability level. The acceptable region for both infit and outfit MNSQ is between 0.50 and 1.50 [12]. However, infit and outfit ZSTD will only be accepted within ±2.0 [17]. According to Haliza, Izamarlina, Hafizah, Zulkifli and Nur Azilah [18], when all the three controls mentioned above cannot be met, the item will be labeled as misfit.

The RMM item analysis was conducted stepwisely and it showed that there were 32 items remained fit in the 32-item-TSSA. There were three underfit items (TSSA3, TSSA4 dan TSSA12) which infit or outfit MNSQ (<0.50) or ZSTD (>-2.0). Based on the results, researcher decided to eliminate three unfit items from the initial 35-item-TSSA.

In the RMM item analysis, separation is defined as the ratio of the true spread of the measures with their measurement error [19, 12]. An estimate of separation tells the level of persons and items can be reliably distinguished [20, 12]. Linacre [12] proposed that the value of separation index for both person and item which are more than 2 is considered good.

The person separation index gives an estimate of the spread of persons along the measurement construct [21]. Low person separation value indicates that the items failed to identify individual differences because of low reliability [22]. Thus, more items needed for the instrument [23]. Besides that, item separation index gives an estimate of the spread of items along the measurement construct [21]. More respondents needed in order to confirm the item hierarchy of the instrument when item separation is low [23].

Finally, Linacre [24] found that person reliability is equivalent to Cronbach's Alpha Coefficient whereas item reliability is equivalent to construct validity.

The fit statistics showed that the person separation index and item separation index were at 6.51 and 2.92 respectively. For the person reliablity and item reliability were at 0.98 and 0.89 respectively. This results indicated that the new instrument, 32-item-TSSA was reliable and valid.

B. Unidimensional

The Principal Component Analysis (PCA) of the residuals in Rasch showed the raw variance explained by measures was at 68.5%. In addition, the unexplained variance in the first factor was at 4.5%. Thus, the dimensionality test demonstrated that the 32-item-TSSA was unidimensional and it was a good instrument in terms of its construct validity.

C. Exploratory Factor Analysis (EFA)

Researcher explored the main dimensions from a relatively large set of latent constructs which often represented by a set of items [25-28]. In this study, researcher applied the five-step EFA protocol which proposed by Williams, Brown and Onsman [14].

At the first step, identification of the suitability of data for EFA must be carried out. According to Walker and Madden [29] emphasised on the basic assumption of conducting factor analysis is the normally distributed interval or ratio data. In addition, Chua [30] viewed that ordinal data with at least four response categories is sufficient for factor analysis as it is assumed normally distributed when more than 200 samples are recruited. Kaiser-Mayer-Olkin (KMO) Measure of Sampling Adequacy [31] and Bartlett's Test of Sphericity [32] should be conducted prior the factor extraction. Hair *et al*. [33] and Tabachnick and Fidell [34] proposed that the KMO index with 0.50 and above as well as $p<0.05$ for the Bartlett's Test of Sphericity are suitable for the EFA. The KMO index and Bartlett's Test of Sphericity indicated that there was relationship among the items and the factor analysis was allowed consequently [35].

TABLE I. KMO AND BARTLETT'S TEST FOR THE EFA ON 24-ITEM-TSSA

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.945
Bartlett's Test of Sphericity	Approx. Chi-square	5062.291
	df	276
	sig.	0.000

Table 1 demonstrated KMO coefficient for the scale was found to be 0.945 and acceptable. Meanwhile, result of Bartlett's test of sphericity, $p<0.05$, indicated that there was strong relationship among the variables.

Next, at the second step, researcher identified the extraction method for conducting the EFA. For this study, researcher chose to use the Principal Axis Factoring (PAF) as factor extraction method as it uses communality estimates and looks into the relationships among measured variables during the factor extraction process.

In step three, the quality of the EFA is determined by retaining correct number of factors [36]. There were several rules and approaches to be followed during factor extraction. For instance, the eigenvalue, EV>1 [31], the Scree test [37] and the cumulative percent of variance extracted at least 40% [38]. Furthermore, according to Reckase [39], the proportion of explained variance by the prime factor in valid scales should be at least 20%. Anyway, the EV>1 rule and Scree test should be triangulated with the priori theory which supporting the study to avoid the misleading results [40].

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	12.670	52.793	52.793	12.318	51.326	51.326	10.203
2	1.434	5.975	58.767	1.110	4.625	55.951	6.272
3	1.347	5.613	64.380	1.029	4.287	60.238	8.878
4	1.270	5.291	69.671	.928	3.868	64.106	10.017
5	.947	3.945	73.616				
6	.682	2.840	76.456				
7	.624	2.598	79.054				
8	.523	2.179	81.233				
9	.497	2.069	83.303				
10	.447	1.862	85.165				
11	.425	1.771	86.936				
12	.390	1.626	88.562				
13	.336	1.399	89.961				
14	.315	1.313	91.274				
15	.299	1.244	92.518				
16	.275	1.147	93.665				
17	.256	1.065	94.729				
18	.251	1.045	95.775				
19	.209	.872	96.646				
20	.200	.835	97.481				
21	.181	.752	98.234				
22	.158	.659	98.893				
23	.142	.590	99.483				
24	.124	.517	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Fig. 1. Total variance explained for the EFA on 24-item-TSSA

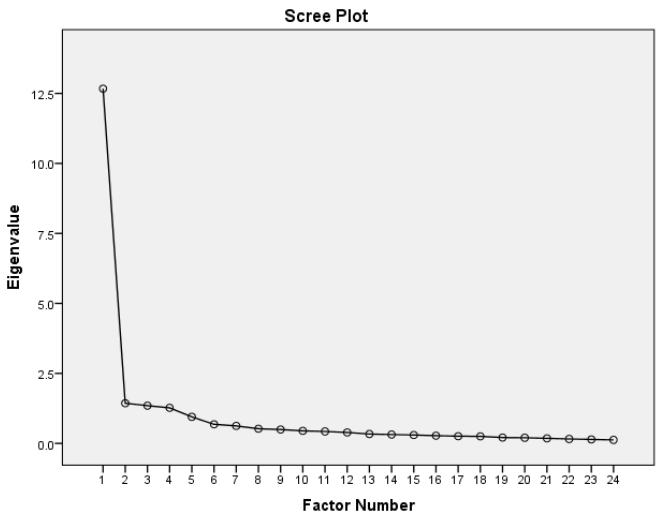

Fig. 2. Scree test criterion for the EFA on 24-item-TSSA

Fig. 1 indicated a cumulative percentage of variance of 52.8% and a total of four factors had an eigenvalue, EV>1. The eigenvalues for the four factors were ranged from 1.270 to 12.670. The prime factor accounted for 52.8% of the total variance. In addition, in Fig. 2, the Scree plot indicated that a

visual "elbow" was found at the fourth point. Therefore, the Scree test indicated that the data should be analysed for four factors.

Ruscio and Roche [41] viewed that the interpretability of extracted factors is increased under the selection of rotational method. Williams, Brown and Onsman [14] revealed that rotation maximises high item loadings and minimises low items loadings. In step four, researcher decided to choose oblique Direct Oblimin (DO) rotation method for this study as believed that the factors under the adapted scales were inter-correlated. Oblique rotations produce the correlated factors which were believed in producing more accurate results for psychological and educational study such as human behaviours [42, 43].

Interpretation of factors was the final step in the EFA. Researcher examined the attributable variables to a factor. The correlation matrix, factor pattern matrix was examined to see the relationship of a specific factor without influencing other variables [44]. The factor coefficients or loadings play crucial role in interpreting a factor [25]. The minimal acceptable loadings would be at least 0.32 [40].

Typically, it is best having at least two or three variables loaded on a factor to constitute a meaningful and interpretable factor [25, 45, 46]. Munro [47] stated that those unrelated items which do not define the construct should be eliminated.

TABLE II. PATTERN MATRIX FOR THE EFA ON 24-ITEM-TSSA

Item	Factor			
	1	*2*	*3*	*4*
II9	0.855			
II10	0.806			
II8	0.774			
II11	0.657			
II2	0.592			
II1	0.583			
II5	0.559			
II6	0.548			
II3	0.478			
II7	0.383			
AU/PT8		0.825		
AU/PT7		0.821		
AU/PT6		0.633		
RI2			-0.785	
RI1			-0.764	
RI4			-0.747	
RI3			-0.682	
RI5			-0.656	
MI4				-0.874
MI3				-0.823
MI2				-0.819
MI5				-0.818
MI6				-0.736
MI7				-0.538

The Pattern Matrix in Table 2 showed that there were four factors were derived from under PAF extraction and DO rotation methods with the factor loadings above 0.32 as suggested. Eight unfit or cross-loaded items (MI8, MI1, AU/PT2, AU/PT1, AU/PT5, MI9, MI11 and MI10) have been detected and excluded from further analysis. Whereas, 24 items were retained after EFA.

Researcher remained all the four factors' name as in the original scale as there was no deletion or merging of the factors. For instance, AU/PT was consisting of three items: AU/PT6, AU/PT7 dan AU/PT8. AU/PT was designed to measure the understanding of students with ASD about others' perspective and emotion. The second factor, II contained ten items: II1, II2, II3, II5, II6, II7, II8, II9, II10 and II11. II was used to evaluate the skills of students with ASD to take lead during the reciprocal interaction. However, the third factor, RI retained all the five items: RI1, RI2, RI3, RI4 dan RI5. RI measured the students with ASD's reaction or response when someone was trying to engage with him or her. Finally, the fourth factor, MI were made up of six items. They were MI2, MI3, MI4, MI5, MI6 dan MI7. MI focused on how well does students with ASD stay on or keep up with the activities involved.

D. Reliability Coefficient of TSSA

The reliability of the items for the finalised STATIC model were determined by calculating the Cronbach's alpha internal consistency coefficient. Nunnally [48] suggested the acceptable reliability required Cronbach's alpha exceeds or equals to 0.70.

TABLE III. RELIABILITY OF EACH FACTOR IN THE 24-ITEM-TSSA

Factor	Number of Items	Cronbach's Alpha Values
II	10	0.927
AU/PT	3	0.868
RI	5	0.900
MI	6	0.929

In this study, the reliability analysis (N=267) yielded satisfactory results (Table 3). The whole scale of TSSA with 24 items was found its reliability at 0.960. However, the variables, II, AU/PT, RI and MI were having 0.927, 0.868, 0.900 and 0.929 for their Cronbach's alpha respectively. In a nutshell, 24-item-TSSA was found to be reliable.

IV. CONCLUSION

The utility of this study depends on its establishment of the reliability and validity of the TSSA. This study produced evidence that the 24-item-TSSA can be a reliable and valid scale to measure the social skills among students with ASD in inclusive education classrooms within Malaysian context.

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