

# Psychometric Properties of the ACT! SG Tools

## Method

The preliminary item-pool was administered to youths between ages 10 – 22, before their commencement of one of 16 programmes run by local youth agencies. Ten of the programmes were run as programmes for at-risk youths according to the MSF YARE Framework. Valid responses were received from 817 youths (the bulk,  $n = 577$ , came from non-YARE programmes), and were analysed as the validation sample to derive the finalized itemset for the ACT! SG Tools.

Factor analyses were conducted to refine the item-pool and to maximize the validity and reliability of the measure. Two versions of the Tools were eventually produced: the 75-item full-form, and the 39-item short-form. The 39-item short-form had been done up based on a genetic algorithm (Sahdra, Ciarrochi, Parker & Scrucca, 2016) which sought to automatically abbreviate “a large set of variables into a shorter subset that maximally captures the variance in the original data” – in this case, seeking to come up with a combination of 39 items to ask and score for, which would correlate highly with scores generated from the 75-item measure.

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### Descriptive Statistics

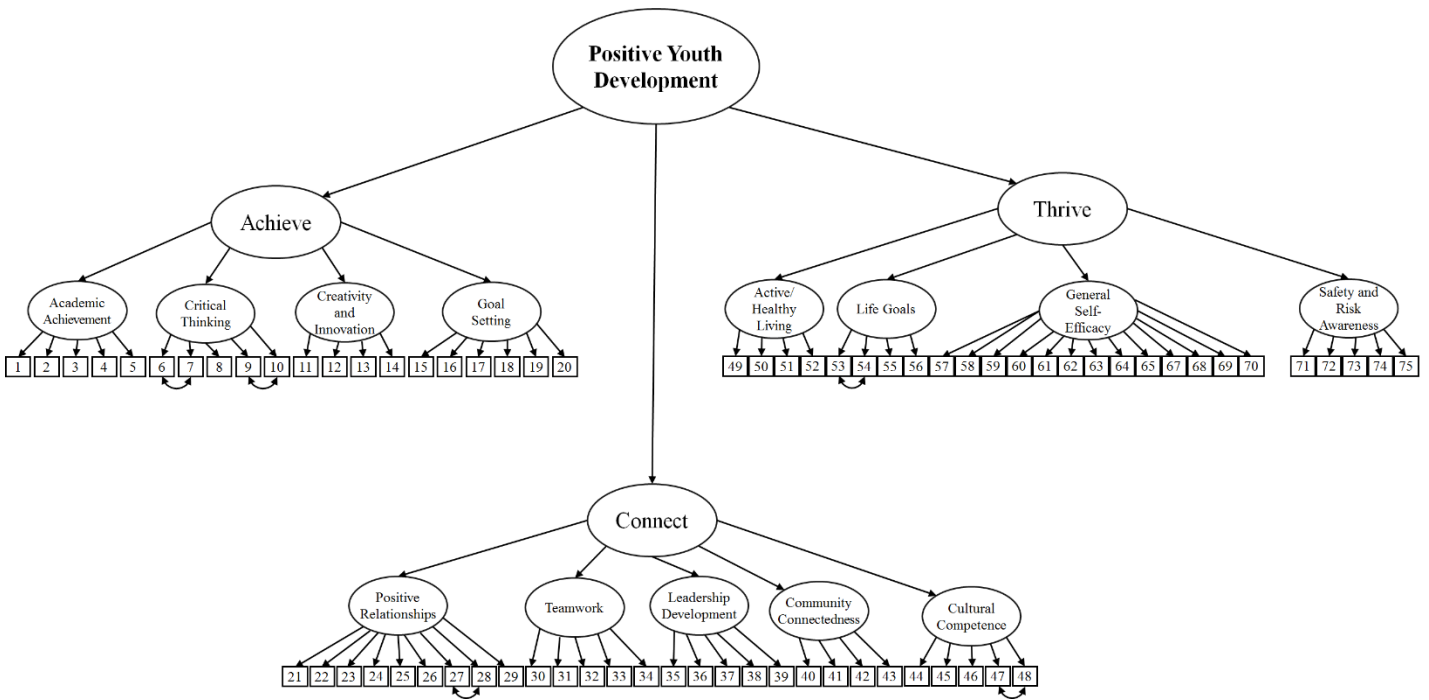
The raw (simple-summed) outcome scores on both Full-Form and Short-Form appeared to be normally distributed. Sample mean scores between the Full-Form and Short-Form are appreciably similar, indicating the success of the algorithm in shortening the scale.

Outcome	Scored According to Full-Form				Scored According to Short-Form			
	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	<i>M</i>	<i>SD</i>	Skewness	Kurtosis
1 Academic Achievement	3.413	.819	-.305	-.046	3.517	.841	-.429	.055
2 Critical Thinking	3.660	.683	-.351	.518	3.638	.722	-.237	.197
3 Creativity and Innovation	3.841	.708	-.633	.863	3.816	.725	-.551	.689
4 Goal Setting	3.926	.682	-.610	.404	3.816	.822	-.608	.236
5 Positive Relationships	3.791	.656	-.724	.922	3.843	.745	-.606	.260
6 Teamwork	3.851	.739	-.684	.749	3.831	.827	-.844	1.044
7 Leadership Development	3.809	.710	-.562	.650	3.727	.764	-.488	.378
8 Community Connectedness	3.621	.856	-.712	.651	3.560	.891	-.693	.533
9 Cultural Competence	4.164	.660	-.772	.523	4.160	.718	-.849	.696
10 Active/Healthy Living	3.625	.772	-.256	-.306	3.611	.834	-.296	-.360
11 Life Goals	3.914	.762	-.596	.337	3.876	.779	-.526	.189
12 General Self-Efficacy	3.709	.644	-.304	.300	3.668	.744	-.244	-.068
13 Safety and Risk Awareness	4.033	.758	-.807	.440	4.012	.861	-.843	.415
14 Achieving	3.713	.569	-.411	.616	3.696	.595	-.412	.551
15 Connecting	3.849	.586	-.619	.808	3.825	.619	-.552	.614
16 Thriving	3.788	.587	-.421	.435	3.792	.600	-.425	.335
17 Positive Youth Development	3.783	.539	-.418	.359	3.775	.546	-.388	.243

Confirmatory Factor Analyses

The final measurement models for the 75-item and 39-item ACT! SG Tools were observed to fit well. These models consisted of a superordinate “Positive Youth Development” factor upon which three subordinate domains (“Achieve”; “Connect”; “Thrive”) loaded on. For each domain, a constituent set of facets loaded upon them, and each facet was defined by a different set of items. Some items within the same facet, for the Full-Form, were allowed to co-vary as they were inspected to have similar content/interpretation:

Measurement Model of Full-Form Measure



As some of the input variables (items) for analysis were evidently non-normal and a Likert-type scale had been used to collect responses, the measurement models were fit according to a diagonally weighted least squares (WLSMV) estimator. All factor loadings were above .40.

Model	Number of Items	$\chi^2$ Statistics			CFI	TLI	SRMR	RMSEA Statistics	
		$\chi^2$ estimate	df	p				RMSEA estimate	90% CI
Short-Form	39	85006.432	741	< .001	.988	.987	.050	.045	.043 - .048
Full-Form	75	5210.053	2679	< .001	.934	.932	.055	.039	.037 - .040

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The stability of the factor structure across time was also assessed. *Posttests* had been received from 73 youths, who responded to the item-pool again at the end of their programme involvement, to provide a matched-sample for further checks on the stability and responsiveness of the measure. While the sample size of 73 posttests was too small for extensive analyses to be done, confirmatory factor analyses on the posttest sample were conducted separately of each facet with its constituent Full-Form set of items. As the construct definition was not expected to change over time, the same facet-level factor structure, as with the pretest validation sample's, was expected to be replicated. This was supported by the analyses, providing evidence that the factor structure was stable across time.

Facet	Number of Items	$\chi^2$ statistics			CFI	SRMR	$\lambda$
		$\chi^2$ estimate	<i>df</i>	<i>p</i>			
Academic Achievement	5	16.966	5	.005	.989	.068	.485 – .959
Critical Thinking	5	12.756	3	.005	.975	.055	.564 – .896
Creativity and Innovation	4	2.013	2	.365	1.000	.050	.633 – .884
Goal Setting	6	54.417	9	<.001	.894	.098	.632 – .869
Positive Relationships	9	75.356	26	<.001	.901	.094	.362 – .849
Teamwork	5	15.686	5	.008	.970	.052	.630 – .797
Leadership Development	5	24.486	5	<.001	.952	.070	.680 – .839
Community Connectedness	4	0.042	2	.979	1.000	.003	.683 – .866
Cultural Competence	5	7.149	4	.128	.990	.039	.629 – .821
Active/Healthy Living	4	15.234	2	<.001	.916	.075	.520 – .875
Life Goals	4	1.748	1	.186	.998	.021	.616 – .938
General Self-Efficacy	14	118.597	35	<.001	.920	.098	.553 – .880
Safety and Risk Awareness	5	11.596	5	.041	.975	.061	.665 – .732

## Internal Consistency

As robust estimators were employed in the factor analyses, ordinal estimates of internal consistency were computed. However, the conventional Cronbach's alpha is generated for the Short-Form to serve as a convenient reference for analysts.

The internal consistency of "Active/Healthy Living" was found to be below the conventional cutoff of .70 for the Full-Form measure. This was not however taken to a problem, as the construct was taken to be a broad-based one with more heterogeneity between items expected. The remaining outcomes had good internal consistency.

In shortening the Tool to its Short-Form, it was observed that internal consistencies would be reduced. However, this was also not taken to be problematic as Ziegler, Kemper and Kruey (2014) had highlighted that such could be naturally expected of short scales; they state that if "a scale is only intended to be used for group statistics, emphasizing efficiency of measurement over internal consistency can be acceptable" and suggested that a focus on construct representation over internal consistency could be emphasized. To achieve this, the algorithm used in scale shortening was sought to maximize the correlation between scores on the Short-Form and the Full-Form – the correlations were observed to be high, therefore signifying that construct representation had been retained.

Outcome	Scored According to Full-Form		Scored According to Short-Form			Pearson's <i>r</i> between Forms
	Ordinal Omega	Ordinal Alpha	Ordinal Omega	Ordinal Alpha	Cronbach's Alpha	
1 Academic Achievement	.840	.854	.708	.706	.670	.955
2 Critical Thinking	.741	.832	.689	.730	.681	.946
3 Creativity and Innovation	.760	.796	.670	.706	.652	.965
4 Goal Setting	.779	.814	.671	.718	.650	.925
5 Positive Relationships	.788	.836	.592	.638	.570	.882
6 Teamwork	.840	.874	.761	.803	.761	.956
7 Leadership Development	.820	.854	.721	.764	.714	.955
8 Community Connectedness	.824	.857	.767	.804	.774	.977
9 Cultural Competence	.741	.848	.731	.793	.712	.954
10 Active/Healthy Living	.652	.664	.609	.577	.532	.952

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11 Life Goals	.789	.871	.823	.775	.756	.978
12 General Self-Efficacy	.867	.889	.693	.736	.681	.886
13 Safety and Risk Awareness	.779	.825	.670	.732	.650	.943
14 Achieving	.810	-	.796	-	.835	.979
15 Connecting	.899	-	.870	-	.886	.976
16 Thriving	.896	-	.799	-	.811	.958
17 Positive Youth Development	.983	-	.987	-	.936	.988

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### Fairness

Strong measurement invariance of the Full-Form scale was established with respect to gender and age, suggesting that all the items in the ACT! SG Tools were demographically fair and could contribute in a similar way to positive youth development across all ages and gender of youth.

Demographic Factor Tested	Level of Invariance	Fit Statistics for Current Model Tested							
		$\chi^2$ statistics			CFI	TLI	SRMR	RMSEA statistics	
		$\chi^2$ estimate	df	<i>p</i>				RMSEA estimate	90% CI
Gender	Configural	7230.831	5358	< .001	.948	.947	.065	.034	.032 – .036
	Weak	6468.586	5449	< .001	.972	.971	.068	.025	.023 – .027
	Strong	7361.721	5582	< .001	.951	.951	.033	.031	.031 – .035
Age	Configural	12159.716	10716	< .001	.958	.956	.085	.029	.027 – .032
	Weak	11922.409	10989	< .001	.973	.972	.101	.023	.020 – .027
	Strong	12677.447	11163	< .001	.959	.959	.086	.029	.026 – .031

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Responsiveness

Both versions of the ACT! SG Tools were tested to be responsive to change at an aggregate level, for the 73 youths for whom both pretests and posttests were returned at the time of analysis. It was expected that there would be improvements in these youths in their positive development, since the programmes the youths were involved in had been run by established service providers in the local youth sector, or were being based on evidence-based service models for at-risk youths. Statistically significant changes were detected between pre- and post-test at all levels of scoring.

Factor	Scored According to Full-Form							
	<i>M<sub>Pre</sub></i>	<i>SD<sub>Pre</sub></i>	<i>M<sub>Post</sub></i>	<i>SD<sub>Post</sub></i>	Summary of Paired-Samples <i>t</i> -tests			
					<i>df</i>	<i>t</i>	<i>p</i>	<i>d</i>
1 Academic Achievement	2.374	.932	3.673	.823	72	11.367	< .001	1.301
2 Critical Thinking	2.690	.735	3.858	.625	72	13.918	< .001	1.588
3 Creativity and Innovation	2.897	.704	4.015	.644	72	13.411	< .001	1.447
4 Goal Setting	2.855	.717	4.031	.632	72	13.584	< .001	1.350
5 Positive Relationships	2.633	.664	3.873	.602	72	16.272	< .001	1.725
6 Teamwork	2.745	.773	3.981	.641	72	13.344	< .001	1.483
7 Leadership Development	2.833	.765	3.960	.588	72	11.602	< .001	1.239
8 Community Connectedness	2.489	.939	3.771	.754	72	12.117	< .001	1.382
9 Cultural Competence	3.181	.610	4.321	.526	72	18.305	< .001	1.987
10 Active/Healthy Living	2.635	.869	3.872	.791	71	14.707	< .001	1.670
11 Life Goals	2.868	.741	4.167	.617	72	15.299	< .001	1.743
12 General Self-Efficacy	2.744	.666	3.900	.605	71	16.246	< .001	1.554
13 Safety and Risk Awareness	2.839	.838	4.056	.719	71	12.227	< .001	1.315
14 Achieving	2.702	.611	3.896	.507	72	18.025	< .001	1.520
15 Connecting	2.765	.582	3.972	.486	72	18.633	< .001	1.616
16 Thriving	2.764	.641	3.964	.540	72	17.726	< .001	1.447
17 Positive Youth Development	2.748	.567	3.948	.466	72	20.743	< .001	2.468

Factor	Scored According to Short-Form							
	<i>M<sub>Pre</sub></i>	<i>SD<sub>Pre</sub></i>	<i>M<sub>Post</sub></i>	<i>SD<sub>Post</sub></i>	Summary of Paired-Samples <i>t</i> -tests			
					<i>df</i>	<i>t</i>	<i>p</i>	<i>d</i>
1 Academic Achievement	2.422	.957	3.776	.844	72	12.012	< .001	1.413
2 Critical Thinking	2.694	.741	3.767	.666	72	13.463	< .001	1.583
3 Creativity and Innovation	2.856	.768	3.984	.697	72	12.300	< .001	1.444
4 Goal Setting	2.817	.857	3.941	.739	72	10.813	< .001	1.273
5 Positive Relationships	2.726	.740	3.998	.662	72	17.501	< .001	2.061
6 Teamwork	2.744	.856	3.977	.649	72	12.649	< .001	1.514
7 Leadership Development	2.763	.825	3.900	.680	72	10.467	< .001	1.234
8 Community Connectedness	2.447	.963	3.703	.802	72	11.741	< .001	1.390
9 Cultural Competence	3.205	.670	4.324	.566	72	15.553	< .001	1.840
10 Active/Healthy Living	2.657	.888	3.880	.845	71	14.260	< .001	1.683
11 Life Goals	2.852	.763	4.134	.659	71	13.870	< .001	1.645
12 General Self-Efficacy	2.722	.787	3.889	.775	71	11.398	< .001	1.343
13 Safety and Risk Awareness	2.731	.925	4.019	.799	71	11.418	< .001	1.354
14 Achieving	2.700	.643	3.867	.539	72	17.084	< .001	2.024
15 Connecting	2.776	.632	3.979	.494	72	18.914	< .001	2.271
16 Thriving	2.739	.672	3.981	.570	72	16.292	< .001	1.924
17 Positive Youth Development	2.741	.589	3.944	.477	72	20.709	< .001	2.475



## Other Properties

- The convergent-discriminant validity of the facets was established via the Full-Form measure. The inter-item correlation between items measuring the same facet, was generally observed to be higher than all inter-facet correlations for the same facet.
- The Full-Form measure was assessed to be readable with at least a Primary 4 education level, based on computerized readability tests.
- Construct equivalence between the Full-Form and Short-Form measures was additionally assessed via confirmatory factor analysis, holding factor loadings to be invariant across items and factors shared in common between the two forms. The fit of this model was observed to be acceptable –  $\chi^2 (2679) = 556.564$ ,  $p < .001$ ; CFI = .926; TLI = .923; SRMR = .041; RMSEA = .041, 90% CI [.039, .043], supporting that from a factor-analytic perspective, the same factors were being measured across both operationalizations.
- The nomological validity of the Short-Form operationalizations was also established via studying how inter-outcome correlation coefficients changed when a Short-Form score was used to correlate with other constructs in the Full-Form ACT! SG Tool, versus when its Full-Form score was used. Generally, the informational loss was trivial; the difference in absolute size of the correlation coefficients were minor (mean difference  $M = 0.033$ ,  $SD = .029$ ). Only 6 out of a total of 136 coefficients compared had a change of more than .10, but even with these changes the correlation coefficient remained significantly sized.

## Other Enquiries

If you have any other enquiries on the development or validation of the tool, you can contact NCSS at:

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